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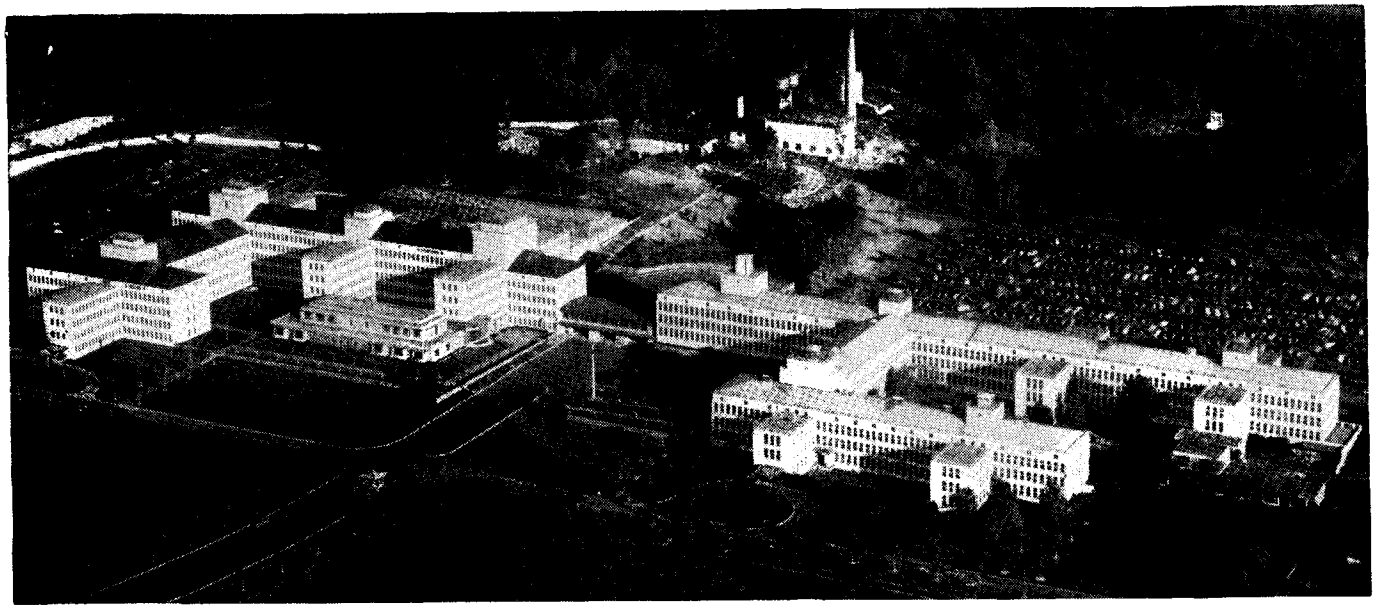

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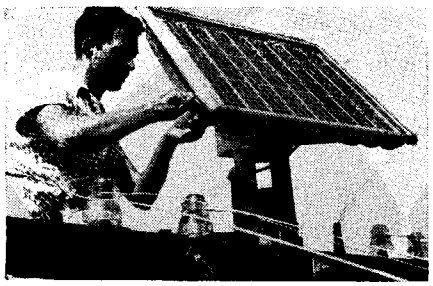

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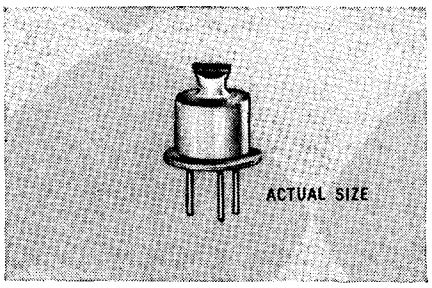


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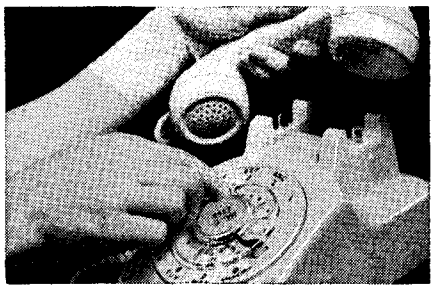

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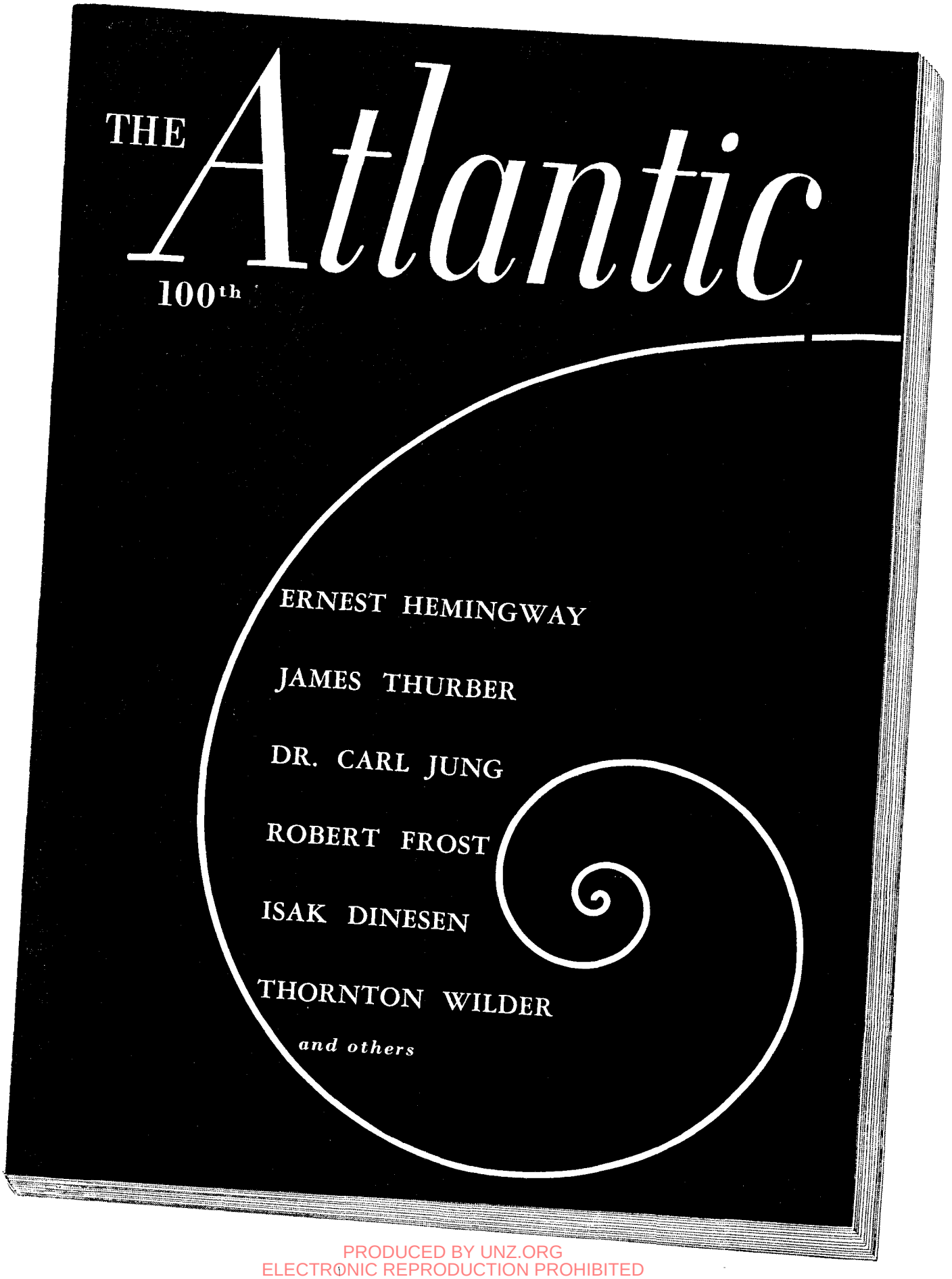


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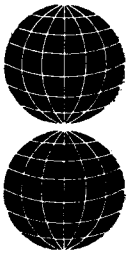
# *The Atlantic Report*  *on the World Today*

## WASHINGTON

THE great political debate of the first session of the 85th Congress, as it turned out, was not over who gained the most in the economy drive or in arguments over national defense. It was, and is, which party, Republican or Democratic, gained politically from the civil rights tussle. The answer can only be demonstrated at the polls in 1958 and in 1960.

Two points which emerged in the Senate consideration of the civil rights measure appear to have the greatest political importance. As to the Democrats, Majority Leader Lyndon Johnson unquestionably kept his party from being torn apart on the Senate floor. As to the Republicans, Minority Leader William Knowland led the vast bulk of them to vote for a stronger civil rights bill (in terms of the political wishes of the Negro leaders and the white liberal organizations), while almost all the Democrats took the other side.

It is clear enough that what Johnson did was a brilliant piece of craftsmanship in the art of leading a party so deeply divided on this issue as are the Democrats. It is clear enough, too, that this was the only sensible thing for him to do in terms of the 49 men who make up the Senate Democrats. It is, however, open to question whether his victory over Knowland and President Eisenhower on the crucial jury trial amendment did not put the Democratic party in the position of having done less for the Negro than did the Republicans.

Most of Washington initially tended to feel that Knowland might have lost a battle but won a war on the jury trial amendment. For it is widely known that no civil rights bill had passed the Senate since Reconstruction days until a Republican President in the White House and a Republican leader in the Senate, even though in a technical minority, went to bat for it. The President's seesaw attitude on the bill may have damaged his reputation momentarily. But after all, only a Republican President's signature could make a civil rights bill law.

Unquestionably the GOP will be out with the loudest trumpets all across those states in which the Negro vote is of growing importance, key states with big blocs of electoral votes in presidential election years. The Democrats are likely to find themselves on the defensive in the North, Midwest, and West. The target of opportunity for developing the Republican Party in the South appears to have disappeared for the time being at least.

### JOHNSON'S STRATEGY

Through the bulk of the weeks of Senate debate, Johnson managed to create the impression of serious discussion by the Democrats of the merits of the legislation. He restrained the racial extremists such as Eastland of Mississippi. More important, he convinced the Southern leader, Russell of Georgia, that a bill would pass in the end and therefore it was in the Southern interest to stick to the merits and fight for the best bill possible from the Southern senatorial viewpoint. This Russell did brilliantly.

Russell and Company, of course, did not want any bill. But it was made clear to them in the cloakrooms, sometimes subtly, sometimes bluntly, that if the Southerners indulged in a filibuster to prevent any bill the filibuster would be broken. Senators from the border states were prepared to vote to break a filibuster once the jury trial amendment was accepted. When Russell learned that Tennessee's Albert Gore was one of this group, he

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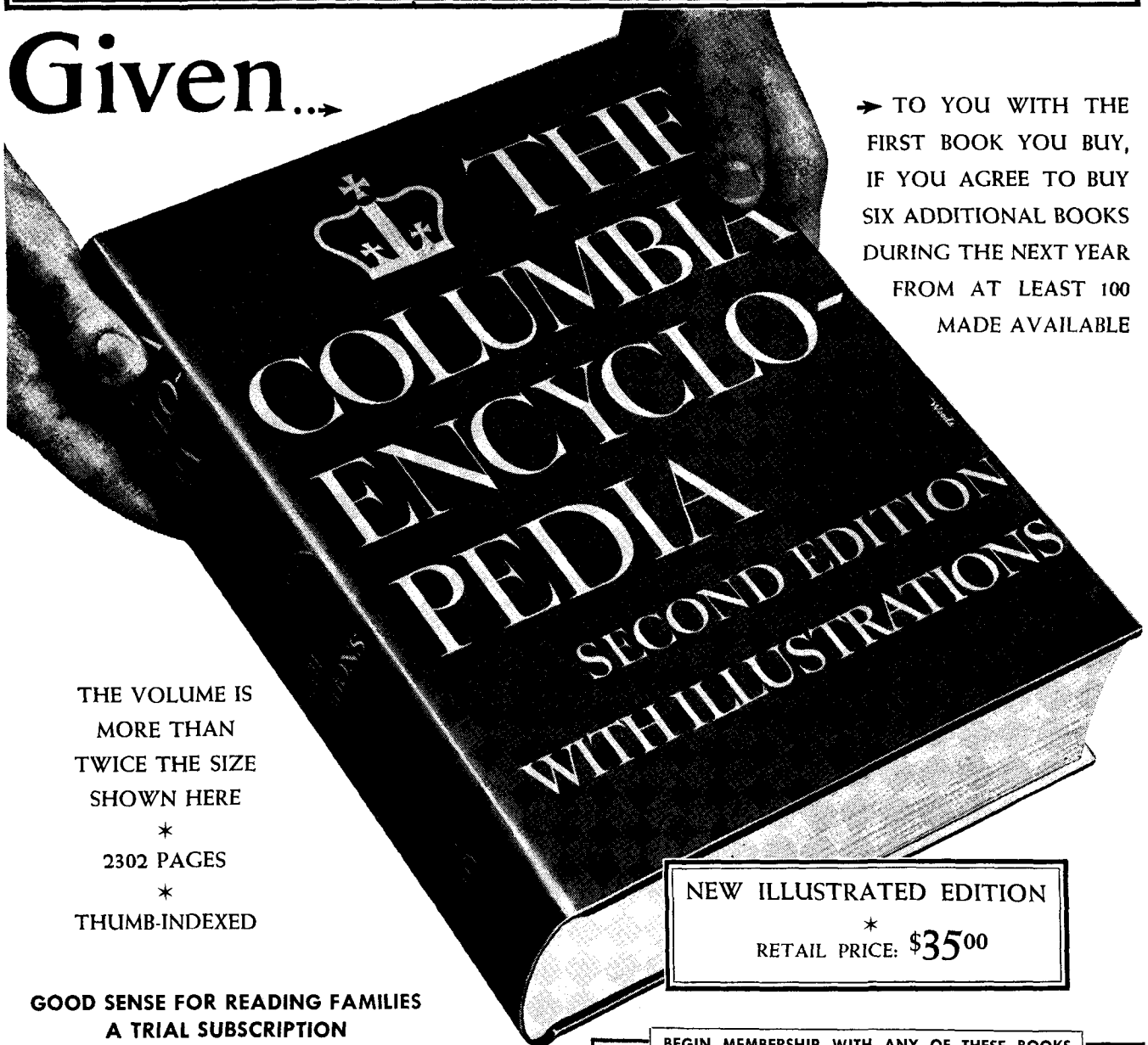


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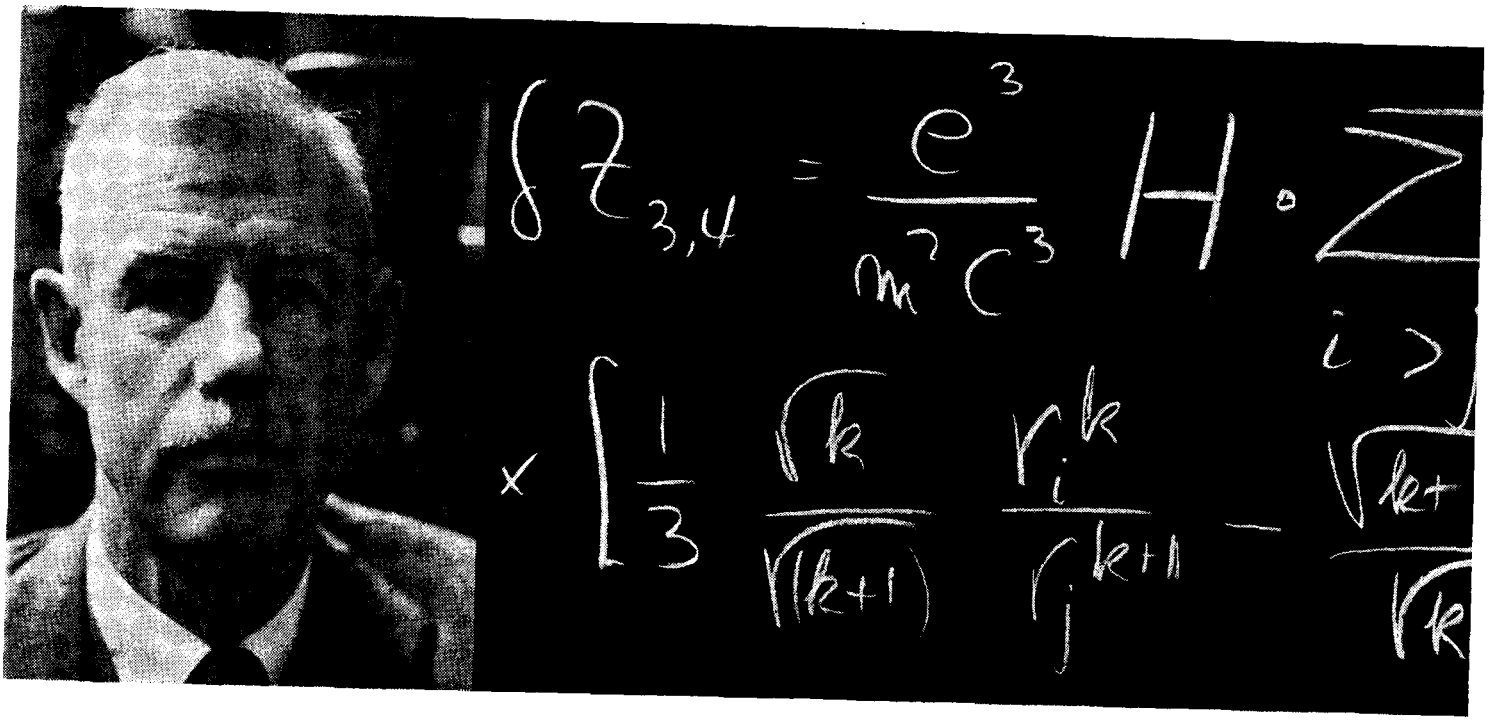

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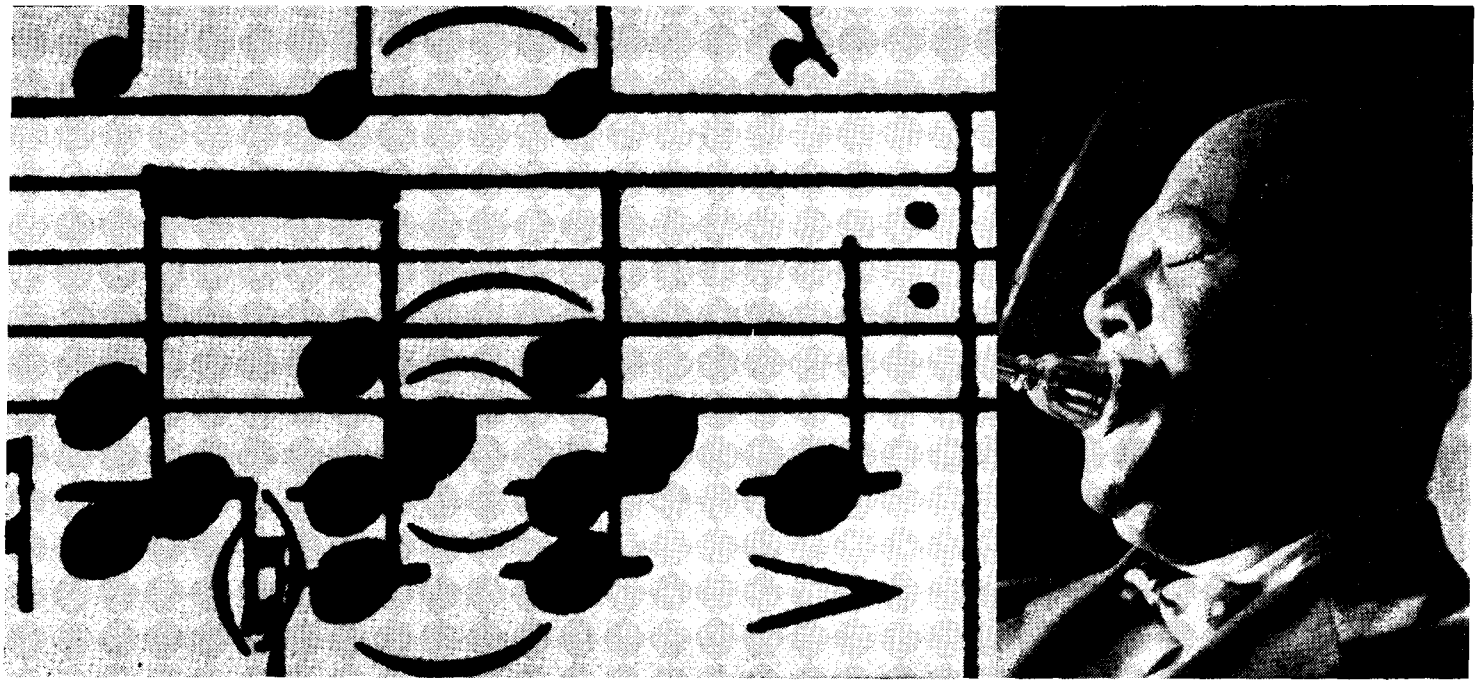

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# The Atlantic Report

## WASHINGTON

knew he must avoid a filibuster, and that he did by exercising his great powers of persuasion, aided by Johnson, on the extremists.

But there was another and perhaps conclusive argument which prevailed against the filibuster. To break such a talkathon under present Senate rules takes the votes of 64 senators, two thirds of the Senate membership. Russell and his colleagues knew that it was within the realm of possibility to run up such a vote against them. They were flatly warned that if cloture on debate by 64 votes failed, the strategy would shift to forcing a change in the Senate rules back to cloture by two thirds of those present and voting, a far easier margin to obtain.

The Southern choice thus was reduced to (*a*) avoiding a filibuster and permitting passage of a limited civil rights bill with the hope that it might die in a struggle between the Senate and House versions, or (*b*) blocking any civil rights bill but risking the probability of a knockdown, drag-out fight leading to a liberalization of the cloture rule. For the 64-vote rule, which now continues to stand, is the ultimate Southern protection against further civil rights legislation of a far more sweeping character than any considered this year, of the type Harry Truman demanded but never could bring to the Senate floor.

In the last days of Senate consideration of the bill, a good many Democrats were convinced that it was Knowland's hope that the Southerners would indulge in a filibuster. At least this argument was used as an added persuader on Russell and his colleagues to let the measure pass. The assumption — never conceded, of course, by Knowland or the Republicans — was that the GOP would have loved to see the Democrats in a rip-roaring party fight.

Once the Senate did approve the measure and the fate of the legislation passed to the House, politics came out into the open far more than it had in the Senate. Top GOP House leaders were freely telling newspaper reporters that they had no intention of saving the Democrats by backing down and accepting the Senate version, even with a proffered limitation on the jury trial amendment.

Johnson, evidently quick to learn that Vice President Nixon was the "top Administration leader" quoted in some news stories as saying the President would veto the bill if it came to him as passed by the Senate, pounced on Nixon with political fury. Nixon had, in fact, been making such statements. He also had said that the President would sign the measure if the jury trial were limited to criminal contempt cases involving voting alone.

All the House Republican maneuvers were designed to force the Democrats to acknowledge "concession" to the GOP. They were done not so much to strengthen the bill as to loosen the Democratic label the Senate had placed on the measure. These political shenanigans, however, became so intricate that they did little if anything to settle the big question — which party will get the political credit for a civil rights bill when the voters next go to the polls?

### McELROY AND DEFENSE

The day before President Eisenhower formally appointed Neil H. McElroy, the Cincinnati soap-company president, as the new Defense Secretary, an Administration official who sits at the National Security Council table was discussing what lies ahead for the new cabinet officer.

"He is going to have the toughest job of all," this man said. "It will be even tougher than Secretary Dulles' job unless State gets us into some sort of jam. It will be far more important than the Treasury post, for the new Secretary of the Treasury [Robert Anderson, who had just succeeded George Humphrey] isn't going to be as important as his predecessor."

There is good reason to accept this judgment. Whether McElroy can measure up to the job, however, is something Washington probably will not be able to tell for many a month. But what he does, or doesn't, do could turn out to be the most important news of the remainder of the second Eisenhower Administration.

The task facing McElroy is simply this: to devise a new military doctrine and to create the military forces necessary to carry it out in the light of the changed and changing nuclear facts of life and the nature of the Communist threat.

### NEW LANDMARK FOR DULLES

As of the day McElroy was appointed, the facts were these: the State Department under Dulles had slowly altered its thinking, moving away from the instant, massive retaliation doctrine of 1953 toward graduated deterrence and acceptance



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## WASHINGTON

of the need for and the possibility of limited wars, even limited nuclear wars. Dulles had reached the point of accepting the idea of limited nuclear war between the United States and the Soviet Union or between their respective "seconds" — provided each thought that the alternative of extension of such a conflict into a global war was unacceptable. This is a major landmark in Dulles' thinking.

What led Dulles to this position was the development of both the so-called "small" tactical nuclear weapons and of the "relatively clean" nuclear weapons, scientific events which offer the possibility of limiting war to the battlefield in contrast to the mass destruction of the multi-megaton "dirty" hydrogen bombs on which the doctrine of massive retaliation was based.

A second factor pressing in the same direction is the budget problem. It is now generally accepted in Washington that unless a new politico-military doctrine is developed and unless the current fratricidal struggle among the military services for money with which to develop rival weapons is ended, the military budget will skyrocket. The most conservative estimates are that within two years, if present conditions continue, the Pentagon budget will rise from the current $36 billion level by at least another $10 billion to around $46 billion a year.

How thoroughly Dulles is convinced that the changing weapons will affect East-West strategies is shown by the private talk he had in London in August with Valerian Zorin, the Soviet delegate at the disarmament conference there.

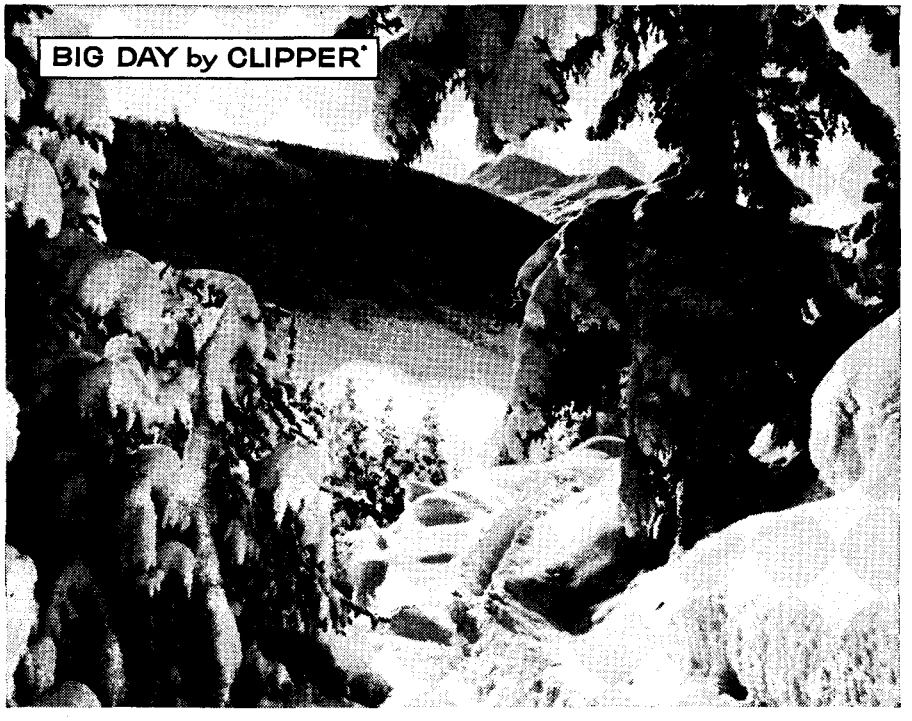
Dulles told Zorin that unless there was an agreement which clearly made a major war less likely it would be better for both sides to go ahead and refine nuclear weapons, both in size and "cleanliness." Then, said Dulles, if war should come, at least it would be possible to avoid the use of the mass destruction weapons. Dulles' point in saying this to Zorin was to convince the Soviets that the United States simply would not agree to end nuclear testing unless there was an agreement to end the production of fissionable materials for weapons use — a step designed to arrest the arms race and to prevent any additional nations from going into the nuclear arms business.

### STATE VS. THE PENTAGON

There is very good reason to believe that Dulles' views here described are also those of the President. The problem lies in the fact that there had been an increasing gulf between the Dulles views and those at the Pentagon under the regime of Secretary Wilson and Joint Chiefs of Staff Chairman Arthur W. Radford. The McElroy appointment, coming as it did at the time Radford was being replaced by General Twining, thus is highly important.

From State's view, it has been Admiral Radford's determination to stick to the mass weapons of destruction and his refusal to see the problems as State sees them which have blocked creation of the necessary new doctrine. Radford's position had been buttressed by Wilson's concentration on procurement problems alone and by the traditional service rivalries and views, among them the dogma, as once stated by General MacArthur, that in war there "can be no substitute for victory."

According to informed Administration officials, Eisenhower sought a new Defense Secretary who not only could handle procurement (hence he wanted another businessman) but who also could tackle the doctrinal problem. Departing Secretary Wilson, fortunately for McElroy, took care of the unpleasant chore of chopping down the existing military machine to fit the new budget levels set by Congress — cuts in manpower, moth-balling of naval vessels, stretch-outs in aircraft procurement, and so on. The deck thus is relatively clear for McElroy to tackle the main job.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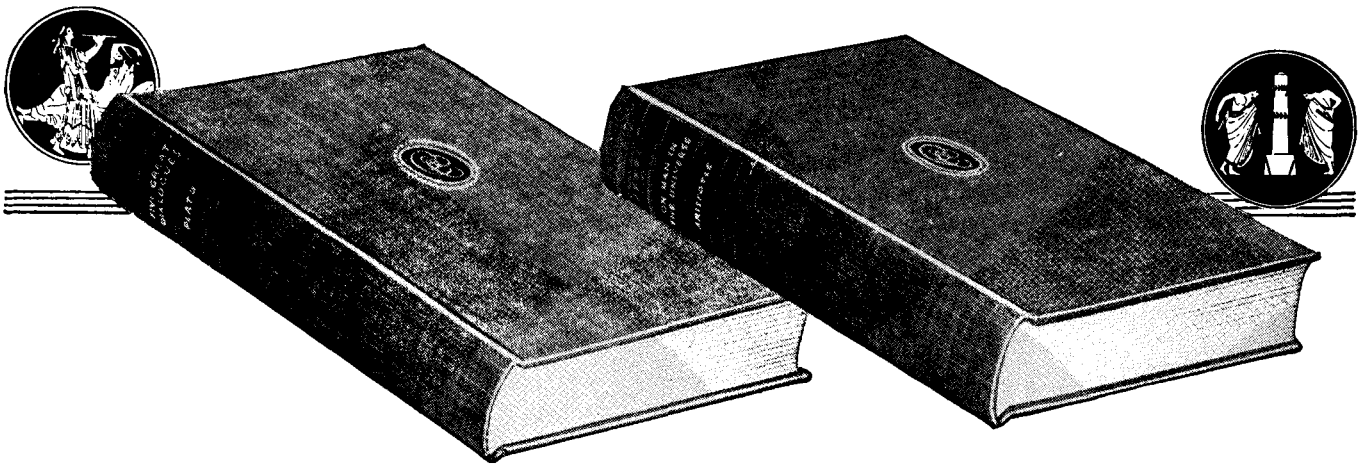

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# *The Atlantic Report* MALAYA

On August 31, 1957, the Federation of Malaya came of age as an independent member of the British Commonwealth and as a free nation in the world. The negotiations between the British and the elected government, headed by Tunku Abdul Rahman, went very smoothly, and this important development was reached with the maximum of good will on both sides. For these reasons the impending changes did not have as much publicity in America as did the more difficult problem of self-government for the separate colony of Singapore. Yet the Federation, small as it is, is a key point in the struggle between Communism and the free world.

Nationalistic politicians sometimes speak as if Malaya had been for centuries under European domination, but in fact only the settlement of Malacca, now a peaceful backwater, has been ruled by Europeans for a long time — since its capture by the Portuguese in 1511. Penang and Singapore were founded as trading posts by the British East India Company in 1786 and 1819 respectively. These three towns until eighty-three years ago were small outposts of British India, cut off from the life of the Malay states by the East India Company's policy of strict nonintervention in the affairs of the peninsula.

In 1874 Britain began to take under her protection the first of the Malay states: Perak, Selangor, and Negri Sembilan. The process was not completed until 1909, when Siam transferred to Britain her sovereignty over the northern states, and 1914, when Johore accepted a British adviser for her internal affairs. In many parts of Malaya, therefore, British rule has been effective for less than fifty years, yet this half century has seen rapid changes.

Most important of these changes economically was the introduction of rubber planting on a large scale and of the modern tin dredge during the first two decades of the present century. These made Malaya the greatest producer in the world of rubber and tin. With the development of these two industries came the building of railways and roads, which bind the country into one economic unit, and the growth of modern towns.

Organized governments were built up for the states and for the country as a whole. Singapore was separated politically from the mainland after the Second World War, but the other two British settlements, Penang and Malacca, were united with the Malay states in the Malayan Union of 1946 and in its successor, the Federation of 1948. Most important of all have been the growth of the population to more than six million and the change in racial composition. Malacca, Penang, and Singapore always had a cosmopolitan population, but eighty years ago the Malay states were inhabited almost entirely by Malay peasants and fishermen under the rule of sultans and chiefs.

With the establishment of internal peace, the Chinese flocked into the western states to develop the tin mines and to act as petty traders. Rubber planting led to the introduction of large numbers of Indian laborers on the estates, so that today the Malays and closely related immigrants from Indonesia form only about half of the population of the Federation, while the Chinese, Indians, and other races account for the other half.

## BUILDING A MODERN STATE

The British officials who were responsible for the building up of organized governments in the Malay states under British protection were interested primarily in development. They welcomed European and Chinese capital for the financing of new industries. The tin mines and the rubber plantations provided the revenue to establish better communications, thus making further development possible. Tin and rubber also provided a revenue for the establishment of the first schools and medical services, and for the departments of a modern government which had to be set up.

British policy up to the Second World War was steadily pro-Malay. It could hardly have been otherwise in the circumstances in which the British had entered the Malays' country, and


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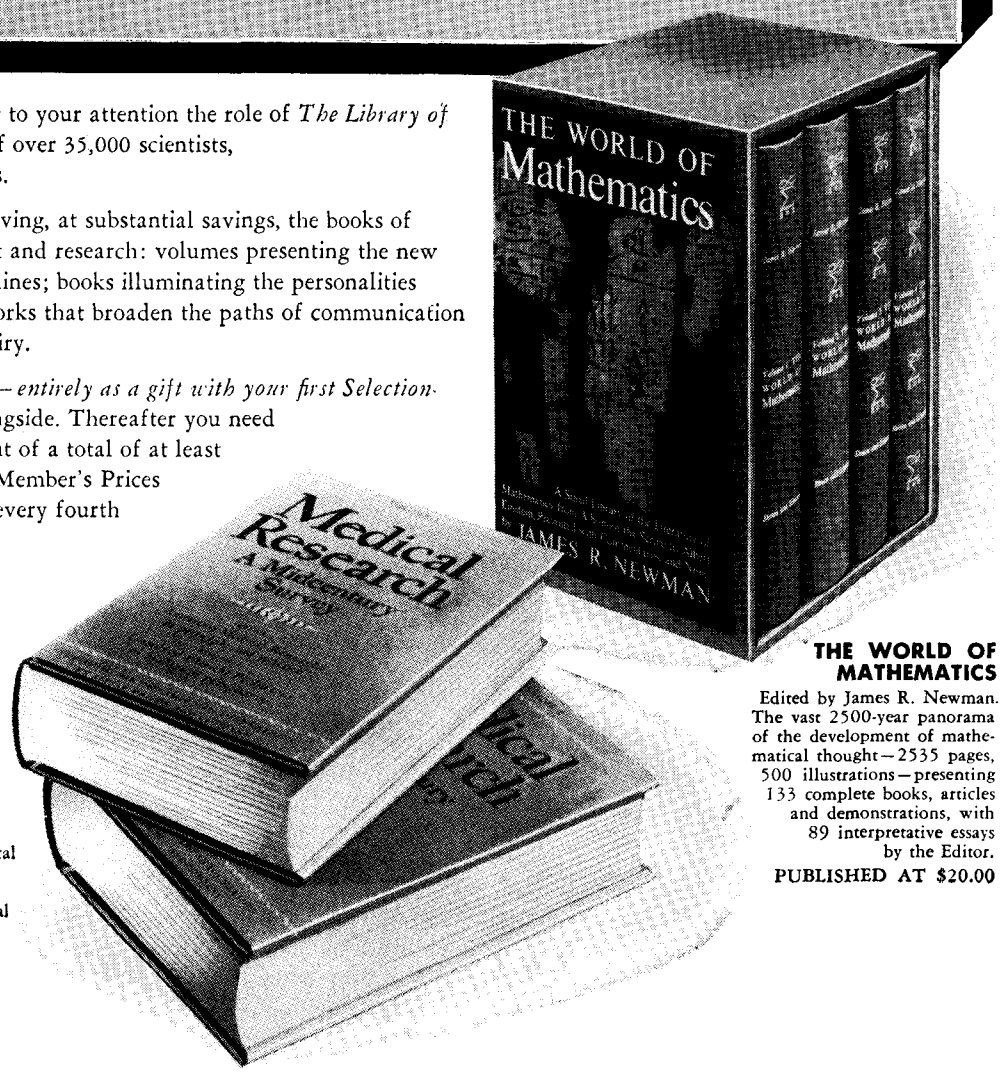


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## MALAYA

it was strengthened by the sincere friendships which existed between the early administrators and the people.

The young British officer was expected to master the Malay language during his first years in the country and would usually serve for many more years in a district, where he was taught to regard the welfare of the Malays as his primary responsibility. The Malay states were never annexed, and the sovereignty of the sultans as constitutional rulers was respected. Local Malay chiefs were consulted and subsidized in return for the surrender of their rights to collect local taxes and feudal dues.

### RACE RELATIONS

In the Malay states only Malays were admitted with Europeans to the key administrative ranks of the Malayan Civil Service. A very large part of the money spent on education went to establish and maintain village schools where Malay children received free elementary instruction in their own language. Large areas of the best agricultural land were earmarked as Malay reservations where no non-Malay could hold a title.

The Chinese, by contrast, were left very much on their own. Sir Frank Swettenham, one of the leading early British administrators, once remarked that they were the easiest people in the world to govern, but with the barrier of a difficult language which very few officials were able to find time to learn, no real attempt was made to govern them except when the nefarious activities of their secret societies threatened law and order.

Since the government did not provide schools for their children to be taught in Chinese, they established schools themselves at their own expense. Inevitably these schools were modeled on the schools of China, and the teachers were in the early days nearly all imported from the homeland. A good many Chinese children attended the English medium schools along with other races, but for the majority the education of the China-centered school tended to isolate a majority of the Chinese community from Malayanizing influences.

Certain sections of the Indian community have prospered because of education in English schools. Only the easygoing Malay, with no inherited business experience, has been left behind, following in most cases his traditional life as cultivator and fisherman. In comparison with the other communities he has not raised his standard of living much, nor has he benefited to the same degree from the provision of modern amenities, which tend to be confined to the towns.

So long as the government was controlled by British officials there was little political consciousness, and generally the relations between the races were good. But the Japanese occupation during the Second World War changed all this. Self-government ceased to be a pious hope in the indefinite future and became a problem of practical politics. It posed the question, "If the British cease to govern, who will take their place?" Malays and immigrant peoples gave different answers, and interracial relations grew more difficult. There were ugly incidents between Malays and Chinese during the interval between the Japanese surrender and the return of the British forces.

The official British view had long been that they were governing the country until the Malays — as the indigenous people — were ready to take over, but even before the Second World War this had become unrealistic. Most of the Chinese and Indians who were born and educated in Malaya regarded themselves as Malayans and could not be excluded forever from political rights in a free Malaya which was their home.

Malay opinion had been alarmed by the flood of immigrants, and under pressure from the rulers the government had restricted immigra-

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## MALAYA

tion by law in the 1930s. Extremists among the Malays to this day want an independent Malaya in which only Malays would enjoy full political rights, with Islam as the established and privileged religion. They look to closer relations with Indonesia and the immigration of Malaysian peoples from the islands to redress the balance between themselves and the Chinese and Indians.

Such a policy, if put into practice, could only lead to civil strife and bloodshed, because the Chinese and Indians are too many and too deeply entrenched to be thrust into permanent political inferiority.

Fortunately, responsible Malay leaders do not hold such extreme views. The Chief Minister, Tunku Abdul Rahman, has shown real statesmanship in stressing the overriding importance of good racial relations and happiness for all who call Malaya home. He is fully aware that the worst possible fate would be a state of interracial conflict such as developed in Palestine, with Malays and Chinese playing the parts of Arabs and Jews.

In their genuine desire to avoid such a tragedy, the Malay leaders have made many concessions to the Chinese and Indians. It has not been easy for the Tunku to justify these to the more ignorant rank and file of the United Malays National Organization (UMNO), of which he is the leader. There is a limit beyond which he cannot go without destroying the basis of his own power.

### THE COMMUNIST REVOLT

Chinese opinion is also much divided. At one extreme is the Malayan Communist Party, which, though it maintains a façade of interracialism, has always drawn most of its membership and all of its leaders from the Chinese, especially from the China-born. The


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## MALAYA

number of professed and active party members in Malaya, as elsewhere, is small, but the movement — by underground infiltration and by active terrorism — has penetrated deeply into the Chinese population.

In 1948, under the orders of international Communism, the Party started an armed revolt, using the organization, methods, and arms it had employed during the war against the Japanese. The triumph of Communism in China gave it added prestige and influence. At the height of what is euphemistically called the "Emergency," in 1951, there were some 7300 terrorists in the jungle and perhaps half a million willing or coerced supporters among the Chinese population. In that year there were 6100 incidents, the most serious being the murder of the High Commissioner, Sir Henry Gurney, in October.

Yet the Communist revolt failed more decisively than in any other Asian country where the Party had taken to arms. The Communists never succeeded in gaining the support of any responsible nationalist leader. The Malays recognized the movement as an attempt to impose foreign rule on their country and rallied to its defense in the police force, the special constabulary, and the Malay regiment. No "liberated areas" under Communist rule were established. The cruelties of the terrorists, from which the Chinese were themselves the main sufferers, alienated public opinion.

Sir Gerald Templer's real, if drastic, leadership turned the tide, and the Communist cause and morale has steadily declined. Today there are only some 2100 terrorists in the jungle; most are disillusioned and held together by their fear of the hard core of 170 top-ranking Communists. As each month passes, their numbers are slowly whittled down by the pressure of the security forces and by surrenders. In 1956 the number of incidents dropped to 435.

The strongest Chinese organization, embracing most moderate opinion, is the Malayan Chinese Association (MCA). Inspired by Sir Cheng Lock Tan, the group was formed by those leaders who rejected Communism, stood for the full identification of the Malayan Chinese with the country, and wished to obtain their ends by coöperating with the Malays. It has enjoyed wide support but has had some trouble with its more conservative supporters, who look to Chiang Kai-shek and the Kuomintang in Formosa, and with the China-born and Chinese-educated sections, who are reluctant to make any compromise on the Chinese way of life in the interests of Malayan unity.

### THE INDIAN MINORITY

The Indians are a minority community and contain within themselves a Tamil-speaking majority and a minority of Punjabis, Telegus, and other groups. As a non-Malay people, their outlook and interests often coincide with those of the Chinese. Their leaders echo the demands for citizenship and for the preservation of their culture made by the larger community. Less organized than the Chinese and divided by personal squabbles between leaders, the Malayan Indian Congress (MIC) has not the prestige of the MCA.

Since racial coöperation is the most urgent necessity for Malaya, the formation of the coalition, known as the Alliance, between UMNO, the MCA, and the MIC in 1954 was a most welcome step. It brought together the leaders of all moderate elements.

At the first elections for the Federal Legislative Council in July, 1955, the Alliance won fifty-one of the fifty-two elected seats. Since then it has assumed most of the responsibilities for governing the country and has been the spokesman for Malaya in the negotiations with the British Government for independence. It remains to be seen if the Malayan attitude can prevail over the communal when the new nation has to face those problems which independence will acerbate rather than solve.


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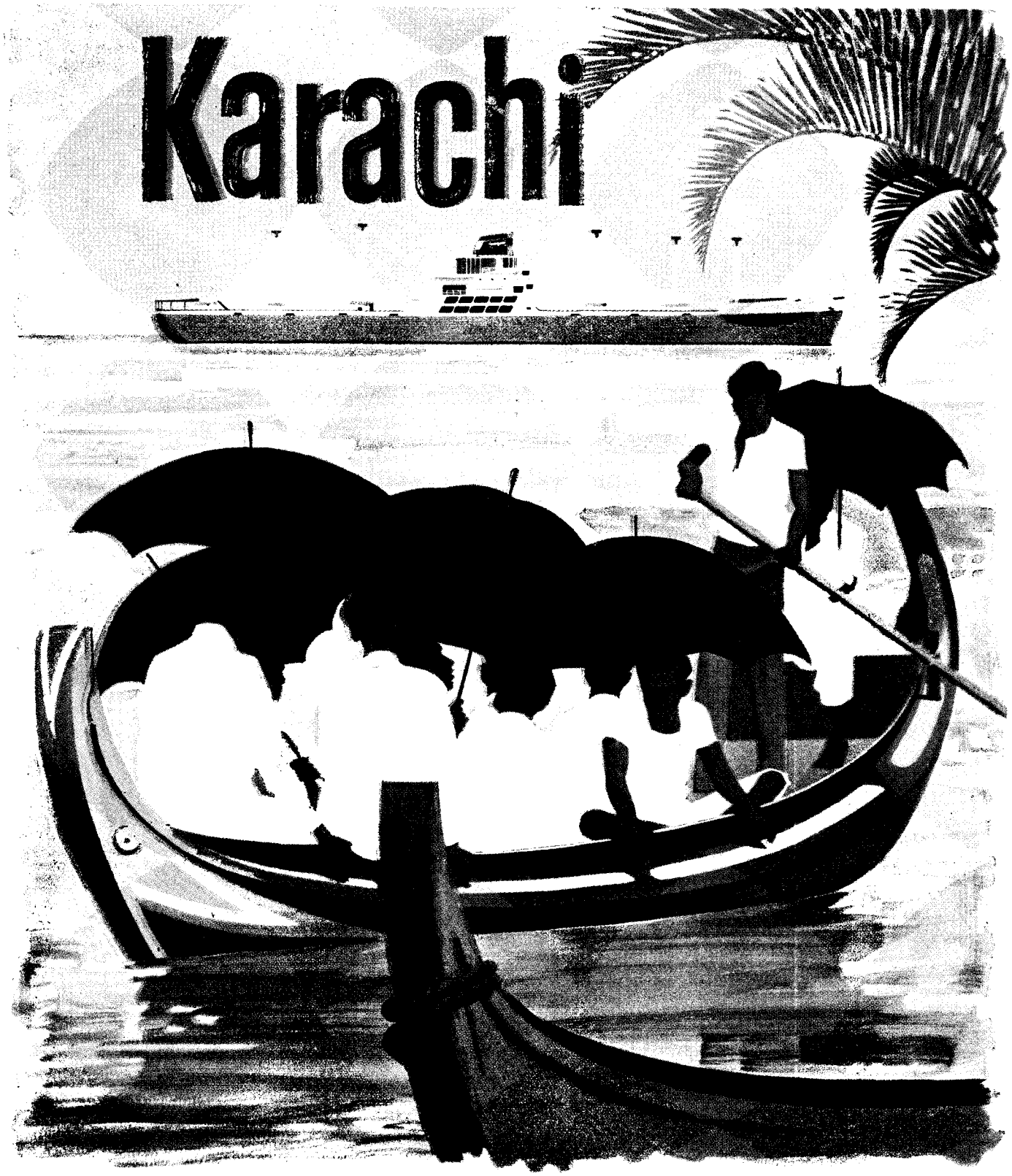


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# *The Atlantic Report* JAPAN

ONE of the many things that impress the traveler in Japan is the avidity with which the Japanese go on journeys. Any day, winter or summer, large, regimented groups of school children go on tours; parties of old men and women from country villages visit the cities and shrines, with a guide trudging along in front carrying a flag; swarms of people crowd trains and steamers.

Politicians and businessmen go in for foreign travel, and Haneda, Tokyo's international airport, is usually jammed with people seeing travelers off or waiting to greet them on their return. Foreign travel, particularly to the U.S.A., gives considerable "face," so that executives, and particularly politicians, try to find an excuse for such a journey. When a politician is fortunate enough to be met and entertained in the U.S.A. by persons of importance, he gains much more prestige. This usually produces many votes among his constituents, since he invariably will mail thousands of post cards from each foreign stop to his followers in the remote countryside and to his poorer voters. To his more important supporters he returns bearing gifts.

This is a firmly entrenched custom in Japan. If one goes on even a small journey within the country it is necessary to bring back *O-miyage* (a gift from the place visited) for one's colleagues, office workers, and servants. Where foreign travel is involved, better *O-miyage* are imperative.

It is also understood that every important politician who goes to a foreign country should bring back a "souvenir." This is not a physical item or a gift to any particular person; it is rather in the nature of a successful negotiation or coup, a particular gain or concession obtained, or a settlement that will enhance the prestige and power of the individual. If he does not return bearing both *O-miyage* and a souvenir, his trip will be criticized and his popularity decline.

As soon as Ishibashi became Prime Minister he announced that he was ready to go to the United States. On Ishibashi's illness and the consequent succession of Kishi, the latter said that he also was ready to go to the United States and hinted that June would be a good time for him. The State Department agreed. Kishi promptly engaged an English-language tutor and, after a preliminary jaunt through Southeast Asia as a sort of training exercise, he set off for Washington.

The Japanese are conditioned to put more trust in a personal approach, a personal meeting, a mutual understanding, than in any written contact or legalistic and impersonal communication. Many students have recognized that in Japan harmony is more important than law and that a harmonious solution of differences on a personal basis is much to be preferred to impersonal diplomatic correspondence. Thus it was only natural that Kishi should wish to meet President Eisenhower and try to arrive at a mutual understanding. But, as everyone in Japan knew, the real purpose of Kishi's visit was to return bearing a souvenir, since Hatoyama had gone to Moscow and returned with his souvenir — the U.S.S.R. Pact.

### KISHI'S "SOUVENIR"

Kishi actually wanted more than one souvenir, and in large measure he succeeded, although on his return certain sections of the press showed doubt that he had obtained anything definite. The Foreign Office and the party spokesmen naturally expressed gratification with the results of the journey, and the official announcements held that Kishi had "completely accomplished his mission." As was to be expected, the Socialists were bitterly disapproving of the whole trip, which they considered solely designed for the aggrandizement of Kishi's party. They claimed that Kishi had not succeeded in satisfying the demands of the people and that his gifts were dross. But despite the critics, Kishi did obtain tangible results, although not the comprehensive souvenir he desired.

### THE NEW CABINET

On his return, Kishi plunged into the turbulent waters of party politics, still disturbed by factional



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## *The Atlantic Report*

### JAPAN

disputes. He reshuffled the cabinet and embarked upon a program designed to strengthen the party control in the Diet.

The composition of the new cabinet is of considerable interest. The new Foreign Minister is Aichiro Fujiyama, a leading industrialist and capitalist who had to resign his positions as officer or director of 184 companies on taking office. His job is to promote the "economic diplomacy" of the government and particularly economic expansion toward Southeast Asia.

Minister of Justice is Toshiki Karasawa, chief of the former "thought police" in the Home Ministry. The appointment of Karasawa brought immediate criticism from the Socialists and left-wingers, and from the teachers' and students' groups, as did the appointment of Matsunaga as Minister for Education.

Ikeda, the Finance Minister, was replaced by Ichimada, a former Finance Minister and former governor of the Bank of Japan. He is a person of great experience and undoubted integrity. His appointment was welcomed by most conservative businessmen who felt that a strong hand was needed in the ministry.

Economically, Japan seems, on the surface, to be enjoying prosperity. The 1956 boom carried over into 1957 in large measure as internal activity continued high. But the soft spots apparent earlier in the year, particularly in the international balance of trade, soon became obvious and dangerous. Beginning in March, Japan continually lost foreign exchange, and the deficit in the balance of payments increased every month to a point where its foreign exchange holdings have fallen to a precarious level.

Efforts of the government to restrict imports, and the tightening

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## JAPAN

of credit by the Bank of Japan, began to take effect in June and July, but even so, an interim loan from the U.S. was needed to tide over the government until exports could catch up with imports. It is expected that the foreign account should be in balance by the end of the fiscal year. To achieve this is Ichimada's first and most difficult problem.

### U.S. TROOPS AND PROFITS

Another factor, ironically a result of Kishi's trip, also tends to aggravate this imbalance. Kishi succeeded in negotiating the withdrawal of certain units of U.S. ground forces. However, the departure of 30,000 troops by December, 1957, may well prove a negative victory, since it is conservatively estimated that Japan will lose at least $100 million per year in procurement for and spendings by these troops and their families, and this cannot easily be replaced.

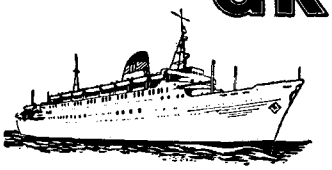
The town of Uchinada earlier learned this lesson. It clamored for the removal of U.S. troops, but when they departed the townspeople soon realized that the prosperity the town had enjoyed was based solely on the purchases by the troops and their families. After a short experience of little business and less profit, the town petitioned the government to send the troops back to Uchinada.

If most U.S. military establishments pull out, some austerity might well be necessary, since it will be impossible to replace the $400 million the U.S. forces currently spend per year in Japan. The Japanese hope to make up these deficits by increased trade with Southeast Asia, Red China, and the U.S.S.R.

### THE EDUCATED ANTI-AMERICANS

There are large sections of the people — particularly among the intel-


MEDITERRANEAN AND GREEK ISLANDS CRUISE



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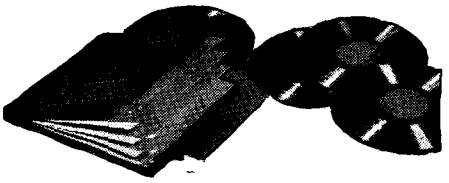

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## JAPAN

ligentsia — who are frankly anti-American, and while only a small number admit to being Communists, a very large percentage are admitted Marxists. One authority reports that at least 60 per cent of the professors and scholars of economics and the humanities are Marxists, and there are almost as many in the scientific and other fields of study. These people are anti-American because, they say, America is capitalist and that per se is bad. They are inclined to swallow Red Chinese and Soviet propaganda rather than to believe the factual and often inept "information" of the Western democracies.

The teachers' unions, which claim 500,000 members, are perhaps the groups most dangerous to democratic ideals, since much of their membership is Communist, extreme leftist, or Marxist. The teachers greatly affect the thinking of the 140,000 university graduates turned out each year, as well as the huge number of students in the technical schools, high schools, and lower schools.

These young people are fed on Marxism and Leninism, told that America is imperialist, American aid has strings attached, capitalism is doomed, and so on. Then they are turned out upon the highly competitive Japanese market where there are not enough jobs for them. These students, the proletariat of the educated, become easy prey for Communist agitators. The Students' Union, the Zengakuren, is officered largely by Communists, and competent observers say that the Soviet places more hope in the Teachers' and Students' Unions than in the Japanese Communist Party itself.

### FAGOTS FOR FANATICS

The publication of the record of the U.S. Senate Subcommittee's interrogation of Professor Tsuru and the subsequent suicide of the Canadian Ambassador to Egypt, Herbert Norman, provided ammunition for the anti-Americans.

As an aftermath of the Tsuru incident, the leading magazines carried articles condemning U.S. McCarthyism, American fascism, American "thought police," and so on. But it is noteworthy that none of the writers criticized the U.S.S.R. at the time of Hungary's struggle. Rather, they made excuses of "foreign reactionaries at work," and took the general line that the U.S.S.R. was justified.

Other events, individually unimportant, have been found and fanatically aggravated into acrimonious issues. The vexed problem of the extension of the airstrip at Sunakawa Air Field, which resulted in violence and riot, and the case of the soldier Girard have played directly into the hands of the Communist agitators and have jeopardized the sober and sincere efforts of the diplomats, officials, and men of good will on both sides.

### THE COMMUNIST PROGRAM

The Communists, after recovering from the blow of the Hungarian uprisings, have embarked upon a cultural offensive. According to the *Zen-ei*, the party magazine, a cultural program for the "defense and development of Japanese culture" is to be developed. This is obviously an attempt to regain the support of those intellectuals who defected because of Soviet actions in Hungary.

The program condemns the "cultural influence of U.S. imperialism," the "cultural networks of U.S. imperialism now under the control of the U.S. embassy," the dispatch of Japanese professors and students to the U.S.A., Fulbright, Ford, and Rockefeller scholarships, and even 4-H clubs. Despite the rabid hatred and vilification of "U.S. culture," the program thereafter sounds almost reasonable and will undoubtedly take in many of the muddleheaded.

### THE STATUS OF THE EMPEROR

Kishi, who actively fostered and supported certain of Japan's prewar and wartime impulses, may have a partial answer to the problem. Some time ago he announced his desire to change the Constitution to make the Emperor "Head of the



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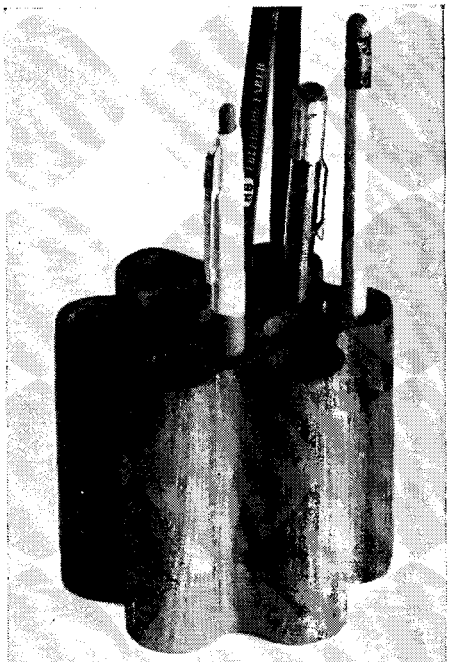

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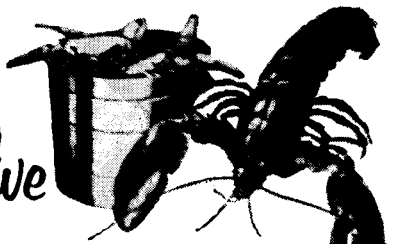

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## *The Atlantic Report*

## JAPAN

State," rather than "Symbol of the State," as it now reads.

This revision would appear to be laudable only so long as the Prime Minister is able to restrict the extreme nationalists and the jingoists who still exist and who could once again use the name and position of the Emperor as their excuse for almost any form of fascist extravagances. The long history of revolt, assassination, capture of the government, and conquest and regimentation of the people in the name of the Emperor should not be easily forgotten.

But certainly some focus for the national affections of the people and for the idealistic aspirations of youth is needed. The revision of the status of the Emperor may provide that focus.

When Kishi returned from the U.S.A., he stated that Japan had entered into a new era. He has asserted Japan's sovereignty and gained some victories. But there is not complete harmony either abroad or at home. In Southeast Asia, the idea of the Asian Development Fund, a means of using American dollars to promote Japanese exports to these areas, has not been accepted wholeheartedly. To many Asiatics it smells a little of a second Greater East Asia Co-prosperity Sphere and hence is suspect. The dissension between Japan and the Republic of Korea has not been healed, nor are relations completely harmonious with Indonesia, Vietnam, or the Philippines.

At home Kishi faces continual party factionalism and, while he holds a good majority in the Diet, Socialist opposition is aggressively obstructionist. Labor is restless, youth rebellious, and the economy precarious. He promised to eliminate corruption, poverty, and violence. If he even partially succeeds, the New Era will indeed be new.


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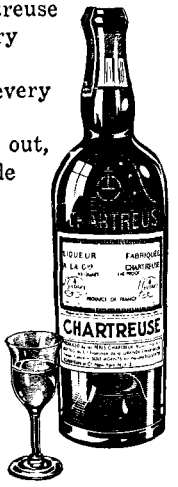


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# *The Atlantic Report* LONDON

THE approach of fall finds Great Britain possessed with the problems of the inescapable boom. Inflation spirals inexorably on. So do rising standards of living for the great majority, hardship for some, production records for industry, sales records for exports, recurrent difficulties for the Treasury, and social changes that are blind.

The parties — Tory and Labor — are puzzled, and beneath the smooth words of their respective dogmas, quite uncertain. "Most of our people have never had it so good," Macmillan declared in July, lapsing into slang. And this heartening fact is obvious to all who live or visit in London. Yet the polls, although they have recently reflected a slight upward trend in Tory support, consistently show a majority for Labor.

Malaya now joins Ghana among the new independent states of the Commonwealth. Yet the Commonwealth itself seems somehow less substantial. Everybody is sure what it is not; nobody seems sure what it is. To some nations, like Canada, the Queen of England is also their Queen. To others, like India, the Queen is simply Head of the Commonwealth. The second title has yet to be given significance.

Meanwhile Europe is closer to home. In recognition of this fact the government has now appointed a "Minister for Europe" in young Reginald Maudling, Paymaster General, who this fall will coördinate the many aspects, economic and political, of Britain's plan for a Free Trade Area attached to the more central Western European Common Market. His appointment is a sign that Britain cannot afford to see a Common Market established from which it is completely excluded.

The British are not halfhearted in support of Canadian Prime Minister Diefenbaker's proposal for a Commonwealth Economic Conference, probably in the spring of 1958, but they are afraid it may turn into a series of embarrassing requests for more capital from the Old Country. To finance Britain's own expansion and at the same time, through a surplus of trade, finance also the development of former colonies — which costs £200 million a year — is likely to prove to be the great external problem facing the Treasury. The economic support of the Commonwealth is almost the same thing as the economic defense of the pound sterling as a world currency.

And yet, although these kinds of greatness may seem to be in the balance for Great Britain, the industrial strength of the country cannot be gainsaid. "Go around this country; go to the industrial towns; go to the farms," Macmillan has advised doubters. "You will see a state of prosperity such as we have never had in my lifetime — nor indeed ever in the history of this country."

### GETTING PRODUCTION UP

A group of official economists has recently concluded that, other things being equal, there is likely to be a "normal" increase of output each year of between 3½ and 4 per cent. In twelve years time the average wage could be £1000 a year (instead of £650). By the time George Orwell's year, 1984, rolls round, the average standard of living may well have been doubled.

It is not yet clear whether inflation is a real threat to all this or simply an annoyance. Full employment has accompanied inflation for a decade. There is, at a pinch, always devaluation. But it is certainly clear that inflation is a threat to the government. Gerald Nabarro, M.P., a sometimes rebellious Tory, was speaking for more than the electors of Kidderminster when he said, "Everybody is fed up with dearer coal, electricity, gas, fares, freights, postage, and everything else. This is the Tory government's last chance."

Inflation has serious social repercussions. New inequalities are produced. The salaried middle class is squeezed until it hurts to the point of emigration. Less privileged wage earners, for instance from the British West Indies, are drawn into the country, bringing with them quite new problems.



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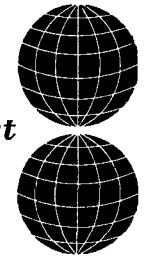
*The Atlantic Report*



## LONDON

In a country that is slowly growing old, there is the overriding problem of the old-age pensioners. There are now 4.7 million of them. They get two pounds a week, which is poverty. To raise this to three pounds would cost the country an extra £220 million a year. And there will be 7.6 million pensioners in 1984.

MORE FOR PENSIONERS?

The Tory answer, besides the continuance of monetary restraints, is a twofold hope. First, that the potential increase in productivity provided by two years of uninterrupted but unused investment made while output stagnated will be realized. Second, that the way ahead can be firmly and acceptably pointed out by an impartial tribunal or commission of inquiry, to be charged with an investigation of the relationships between output, wages, profits, and inflation.

This project has been called an abdication of government by some observers. But the support given to it by Lord Beveridge reminds one that twenty years ago the Beveridge Report, investigating social welfare, laid the foundations of an all-party agreement on the institution of the welfare state.

Labor's practical, rather than theoretical, answer is a proposal for an immediate increase of one pound a week in pensions; half pay on retirement for every statistically average wage earner by the end of the century; and a national superannuation scheme for all with built-in safeguards against inflation (pensions rising automatically with prices and wages). The basic principle would be that of normal contributory insurance, but the state would also contribute the equivalent of 2 per cent of each person's earnings to the insurance fund. The fund would be encouraged to invest its money in ordinary industrial shares.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"For the perfecting of the saints, for the work of the ministry, for the edifying of the body of Christ; (Ephesians 4:12).

"That we henceforth be no more children, tossed to and fro, and carried about with every wind of doctrine..." (Ephesians 4-14).

Our conscience alone compels in us a sense of obligation and responsibility to God. But a good conscience does not provide us with an understanding of God's revelation concerning us. If it did so, there would have been no need for Christ to come among us to preach and give example. There would have been no need for Him to provide us with apostles and prophets, evangelists, pastors and teachers. There would have been no need for Him to say to His disciples: "go ye therefore and teach all nations..."

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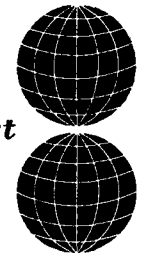
## *The Atlantic Report*



## LONDON

This attractive-sounding scheme acknowledges that the state can no longer finance pensions wholly out of taxes. It declares that flat-rate or completely equal pensions are "the very opposite of social justice." It means the socialist state would in future acquire an interest in seeing that private industry is profitable. Against it, opponents argue that because it would not be entirely funded it could itself prove inflationary, borrowing from tomorrow to pay today. And it could bring on "back-door nationalization" through the control of shares.

### LABOR'S NEW PLATFORM

Control of industry, rather than outright nationalization, is the key to the new policy statement on public ownership by the Labor Party's national executive. Renationalization of the steel industry, returned to private ownership by an earlier Tory Government, is pledged along with the completion of the nationalization of transport. All other previously nominated industries — cement, sugar, chemicals, engineering, shipbuilding — are reprieved unless "after inquiry they are found to be seriously failing the nation."

Through the acquisition of share holdings, the Labor Party declares, industries could be either influenced or controlled. The community would also be guaranteed "the opportunity of participating in the almost automatic capital gains of industry." An attack on "the purchase of privilege" by big companies for their executives — expense accounts, cars, meals, travel, free houses, company-paid chauffeurs, interest-free loans — is also promised. A code of conduct for big business "if need be would be given the force of law."

Trade unionists, however, in and out of Parliament have attacked this policy statement, although it has been issued under the joint signatures of, among others, Hugh Gaitskell, Aneurin Bevan, Harold Wilson, and Ian Mikardo. In part this attack comes because to orthodox Socialists of the old school the new policy is clearly "a policy of retreat." Where, they ask, is the march toward the nationalization of production, distribution, and exchange?

### STRUGGLE AGAINST INFLATION

There does seem to be general agreement on one point: "If a nation pays itself 7 percent more for doing no more work, as happened last year, price increases will follow as night follows day," as Peter Thorneycroft, the Chancellor of the Exchequer, put it. In four years the nation has paid itself 25 per cent more for 8 per cent more output. That realization haunts the nation. And from this background rises a new figure of power and importance — Frank Cousins, general secretary of the Transport and General Workers Union.

Cousins inherits the union that Ernest Bevin built, the largest in the country. Its members have been involved, officially or unofficially, in most of the strikes that have recently had wide publicity — the Covent Garden market porters, the provincial busmen, the dockers. And Cousins has recently issued his own terms to the Tory Government: no wage restraint without the imposition of socialist controls on profits, prices, and luxuries.

This is all for the good of the Labor cause, but it may be a significant fact that attention has been diverted from Sir Tom Williamson, chairman of the Trades Union Congress, and focused on Frank Cousins. When a Labor Government is in power, or looks as if it might come into power, the TUC must tag along, for in effect it is or is going to be part of the government. But individual unions still maintain the right to differ. The balance of power in the Labor Party between Gaitskell and Bevan may one day depend on which side Cousins chooses.

### THE PATTERN OF DEFENSE

Uncertainty over defense policies also plagues both parties. The pattern of defense was irrevocably set when Clement Attlee decided that



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## *The Atlantic Report*

### LONDON

Britain must make the atom bomb. But Defense Minister Duncan Sandys' ruthless paring of the Army to 160,000 men, all regulars, by 1962 has shaken more than the old guard. Will 160,000 be enough to fulfill Britain's Atlantic commitments and also to provide the highly mobile striking force that is envisaged for possible "limited wars"?

Some British strategists are also asking whether there can be such things as limited wars any more. Did not Suez show that a limited war will soon break its limits and draw in more powerful outsiders? Does not Cyprus illustrate the difficulties of a limited army facing almost an entire population? And how limited, really, was Oman?

In Cyprus Britain has given up its claim that the island is vital to the Commonwealth for defense purposes. By this much the situation is clearer and easier. The difficulty now is the deepening division between the Greek and Turkish elements of the population, backed by their respective homelands.

In Oman, Britain went to the help of the Sultan to encourage the others in near-by British-protected oil sheikdoms like Kuwait and Bahrein. Once again the necessity for a proper Anglo-American understanding of aims and means in the Middle East was stressed. For Oman has uncovered the possibility of a clash between the new American interest in the Middle East, based on Saudi Arabia, and the remains of the old British interest, exemplified by the Sultan of Oman.

In spite of Washington denials, the British public remains half convinced that America is after British oil. The *Daily Express* notes that in ten years the proportions of holdings of Middle East oil have been almost reversed, Britain now owning but 27 per cent and America 51 per cent.


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# Atlantic Repartee

## LETTERS TO AND FROM THE EDITOR

BILLY GRAHAM

SIR:

I have read "Repartee" in the August issue and am surprised that anyone should have been so offended as to cancel his subscription because you published R. B. Robertson's "When Billy Graham Saved Scotland" (June *Atlantic*). In fact, I don't see how the people who are that offended could have enjoyed reading the *Atlantic* while they were getting it; the humor in the magazine, at least, must have passed them by.

WERNER K. HONIG
*Durham, N. C.*

SIR:

. . . The *Atlantic* is wasted upon those who canceled their subscriptions in protest.

AGNES THOMPSON
*Lawrence, Kan.*

SIR:

In our society big business is often censored and exposed. If the followers of Billy Graham cannot withstand Dr. Robertson's lighthearted exposé, they had best return with Mr. Graham to a small country parish in North Carolina.

GARY R. FRINK
*Rochester, Mich.*

SIR:

As a college sophomore, and not the type one might call intellectual, I was truly disillusioned by the supposedly intelligent *Atlantic* readers who objected so strongly to "When Billy Graham Saved Scotland," by Dr. Robertson.

JOSEPHINE MCGILLIS
*Detroit, Mich.*

SIR:

This letter is in response to those canceled subscriptions which resulted from Dr. Robertson's astute article.

It is very unfortunate that some "tolerant intellectuals" still cannot endure dissent. I want you to know that it is because of these high-caliber, stimulating articles that I have extended my subscription three more years.

DAVID ZIMMERMAN
*Flushing, N. Y.*

SIR:

. . . The shock of subscription cancellations lies, I think, in the nature of the publication which is canceled, for the subscriber surely realized long ago the literary quality of the magazine, the overall continuous policy which its hundred years testify to, the controversy on which each small iota of truth has progressed up to this day and time.

W. T. BURKETT
*Dothan, Ala.*

SIR:

. . . As I regard Billy Graham as a kind of disease we have to try to live through, I never gave the article a thought until I got the August number and saw the furor you had raised. I have now read it and am highly entertained and shall watch for Dr. Robertson's book, *Of Sheep and Men*, with interest.

MARION J. CLARKER
*Toronto, Ont., Canada*

SIR:

I waited for the August issue to arrive to look over the repartee occasioned by misuse of the clever story by Dr. Robertson. . . .

Your resort to "yellow" journalistic exploitation with a blatant display of bold headlines on the cover has surely caused loss of faith in the character of the *Atlantic*, long highly admired.

MEADE C. DOBSON
*Public Relations*
*Kew Gardens, N. Y.*

SIR:

. . . Don't cancel my subscription. Continue to send the *Atlantic*, and next May I shall send my letter of renewal. . . .

JAMES P. KEARBY
*Forth Worth, Tex.*

SIR:

The people who ordered cancellation of their subscriptions are unable to bear the thought that opinions held by others might be divergent from theirs, and perhaps just as valid. The sole reaction that such a discovery engenders in them is a desire to suppress whatever is at odds with them. . . .

S. LUKS
*Montreal, Que., Canada*

SIR:

. . . Never fear, dear worried readers, Mr. Graham's type of emotional appeal will continue to thrive in spite of common sense. I grew up in that type of environment which advocates that unless you hear a good old-fashioned hell-fire sermon at least once a week you just don't jive, brother.

It is inconceivable to some people that others might just object to a philosophy that has only emotional appeal. For heaven's sake, give us more ministers who teach of justice



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and equality and less of those who tell us we are going to die and go to hell unless —

F. E. SMITH
*New Orleans, La.*

SIR:

I have just read the sampling of letters printed in the August *Atlantic.*

About half seem to be from objectors, whose objection to the article is given expression in most instances by canceling subscriptions. I find it somehow very frightening indeed to know that so many people, literate enough to read the *Atlantic*, should feel that Dr. Robertson's description was intolerable.

I believe in the genuineness of Billy Graham, but I found nothing offensive in what Dr. Robertson wrote.

Having seen eight years of newspaper service, and during it having been exposed to a considerable variety of religious expression, I think the churches can benefit by a bit of Graham's spirit, which is conspicuous for avoidance of sectarian bickering while avoiding also our contemporary religious vacuity. . . .

I am not a relative of the writer of your article.

THOMAS H. B. ROBERTSON
*Springfield, Mass.*

SIR:

I congratulate you for the wave of indignation that the Robertson article aroused. The emotional and irrational quality of these letters makes one seriously doubt whether Graham's technique and message has any enduring spiritual value for Christians.

Christians should seriously consider the consequences of this technique before accepting Graham as a twentieth-century Wesley. One such consequence is reflected in the letters you received.

DAVID F. MORGAN
*New York City*

SIR:

Succumbing to hell-sent temptations, I have deigned to read "When Billy Graham Saved Scotland" thrice. Between that article and your advertisements for Irish whiskey you seem to have aroused the somber element in the religious field. The letters to the editor by shocked patrons are exceedingly amusing. I, for one teen-ager, heartily approve of such spoofing.

BARTHOLOMEW J. CORBETT
*Beverly, Mass.*

SIR:

. . . The narrow-minded subscribers who hastened to cancel the *Atlantic* because of one article have yet to learn the art of disagreeing.

MRS. JOAN K. HAMMER
*Philadelphia, Pa.*

SIR:

. . . Those who discontinued their subscriptions remind me of something that happened in the days of Horace Greeley. That free spirit edited the New York *Tribune*. He did not always please his readers. One day he was met in the street by an irate gentleman who fairly yelled at him, "I stopped your paper, Mr. Greeley."

"That's too bad, too bad," Greeley answered. "Let's go to the *Tribune* offices and have a look."

When they entered the building the presses were going in full swing. Mr. Greeley turned to his angry subscriber. "I thought you said you stopped my paper."

"I meant I stopped my subscription."

"You have a right to do that, sir. But the *Tribune*, as you see, goes on and will continue to do so."

The *Atlantic* can, fortunately, say the same.

OSCAR LEONARD
*Harmon-on-Hudson, N.Y.*

SIR:

. . . The few readers who canceled their subscriptions merely show that they do not belong in the camp of thinking readers.

All I can say is good riddance to them. Many more will come in their place.

ELIAS J. STONE
*New York City*

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## FRESH APPROACH TO HANDEL

Last December Leonard Bernstein asked us over to Carnegie Hall where, with the help of the New York Philharmonic and the Westminster Choir, he was preparing a new version of Handel's "Messiah." He explained that every performance of "Messiah" is a version of it, because the work comes to us from a period before music publishing was sufficiently organized to give us a definitive edition for all time. We heard his version and were mightily impressed with his scholarly and interesting approach. He has eliminated a lot of the Victorian plush from the score. He has made certain discreet cuts, and rearranged the original three sections into two . . . a Christmas and an Easter portion. This way a sometimes unwieldly piece becomes more coherent, and each section becomes a neat emotional entity. What he's after is a more dramatic, meaningful "Messiah." That he's successful is everywhere evident in this joyful, spirited performance, recorded shortly after its Carnegie Hall debut.

**HANDEL:** Messiah—
Leonard Bernstein conducting the New York Philharmonic with Adele Addison, Russell Oberlin, David Lloyd, William Warfield and the Westminster Choir, John Finley Williamson, director.
M2L 242 $7.96

## FANTASTIC FANTASTIQUE

Around the same time Thomas De Quincey was describing opium visions with words, Hector Berlioz was setting opium visions to music, with the result that almost nobody knows De Quincey's book nowadays, and almost everybody knows Berlioz' *Symphonie-Fantastique.* The *Symphonie* has been in the repertory of the New York Philharmonic since 1866, when this venerable institution first introduced the work to America. Last season, Dimitri Mitropoulos proved once again what an extraordinarily vital piece it is. *The New York Herald Tribune's* critic was moved to observe that Mitropoulos' interpretation was that of "a conductor with evident devotion to this Symphony and a persuasively communicated understanding." (Incidentally, the *Symphonie* calls for tympani, bass drum, gongs, triangles and cymbals. When the hi-fi set discovers this new recording, we will perhaps have heard the end of records devoted to train whistles.)

**BERLIOZ:** Symphonie-Fantastique—
The New York Philharmonic, Dimitri Mitropoulos, conductor.
ML 5188 $3.98

OCTOBER IS NEW YORK PHILHARMONIC MONTH

## SUBLIME (AND UNIQUE) NINTH

Recording a symphony is all part of a day's work for a record company. Beethoven's 9th, however, has assumed a lofty position in the symphonic hierarchy. When it comes time to record it, it is traditional for record companies to round up their most impressive forces, to assign their most revered conductor and, in general, to turn themselves inside out for the job. Even after the chorus and orchestra have gone home, the work continues. For any 9th worth its salt must be housed in an elaborate box with at least a pound of reading material, and priced as though it were the original MS. Our new 9th, a sublime performance by none other than Bruno Walter, breaks somewhat with tradition. To begin with, it's the first truly great 9th to be contained on a single (LP) record. Furthermore it comes to you in the customary envelope with reading matter confined to Schiller's "Ode to Joy" (in German and English) plus a few pertinent facts and figures. As Columbia's October Buy of the Month it is being offered at just $2.98. We think it's one of the finest recordings and one of the most extraordinary values we've ever made available!

**BEETHOVEN:** Symphony No. 9 in D Minor "Choral"—Bruno Walter conducting the New York Philharmonic, with Frances Yeend, Martha Lipton, David Lloyd, Mack Harrell and the Westminster Choir, John Finley Williamson, director.
ML 5200 $2.98
(for a limited time only)

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Aside from being one of the most engaging new personalities to emerge in the last decade, Polly Bergen can do almost anything. She's got a mind as good as her looks, as anyone knows who's watched her antics as a panelist on TV's "To Tell the Truth." And she *acts* as well as she *sings,* to wit her recent performance on "Playhouse 90" as Helen Morgan ("Bergen Sings Morgan" CL 994). With the soon to be released film on Helen Morgan's life and era the "Bergen Sings Morgan" album becomes an indispensable part of your record collection. Miss Bergen's newest Columbia release is "The Party's Over." If it weren't for the title song, one of the hits from "Bells Are Ringing," the album might just as well be called "The Party's Just Beginning." You'll find out why when you buy it.

**THE PARTY'S OVER:**
Polly Bergen
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ATLANTIC

# EACH ONE TEACH ONE

BY FRANK C. LAUBACH

*Though he would never admit it,* DR. FRANK LAUBACH *is today the most efficacious American missionary on foreign soil. A graduate of Princeton, class of 1909, who took his doctorate at Columbia, he made his first visit to the East in 1915. Since then he has perfected a swift method of teaching illiterates how to read, a method which he has adapted to more than two hundred languages in ninety-one countries. At a conference at Washington University, St. Louis, he gave this graphic account of his mission and his method to Professor Houston Smith over Station KETC.*

SMITH. In the early sessions of this conference on science and human responsibility, we tried to sharpen up some of the momentous problems which science is posing for man: the problems of lowering the danger of war and rising to the tremendous economic challenges that face us.

Dr. Laubach, I've heard you say that your view on these things is essentially a worm's-eye view. What do you mean by that phrase?

LAUBACH. I mean that I've lived down among those people on the other side of the world who are illiterate — the three fifths of the world who cannot read and write — and I know what they are thinking about. I have lived there a great deal longer than I have lived over here. So I know how they look at you privileged people on this side of the world, and I share, to some extent, their viewpoint. A worm's-eye view is the view from down below, looking up.

SMITH. How many years have you spent among these people?

LAUBACH. Forty-one years. I went out in 1915 to the Philippine Islands, and since 1930 have been traveling all over the world. I have worked in ninety-one countries in Asia and Africa and Latin America.

SMITH. Have you noticed any changes come over these peoples through the years?

LAUBACH. Oh, titanic changes have come over them! When I first started, they had their heads down, they had no hope, they were in despair. But all that is changed now. There is a tremendous new determination on the part of all these people who represent three fourths of the human race; they are determined to come up.

SMITH. What has caused this change?

LAUBACH. There have been a great many forces playing on them. For example, our new scientific discoveries have enabled us to make the thousands of isolated communities into one world. We have swift steamships, we have automobiles, we have the airplane, we have motion pictures. Missionaries have been spreading a gospel of the dignity of every human being all over the globe. Our soldiers have gone to all parts of the world, and the natives have seen our tourists and businessmen. They had heard of Woodrow Wilson's Fourteen Points. They have also heard about the Four Freedoms and our democratic idea that all men have a right to "life and liberty and happiness." All these things, together with the Japanese slogan of "Asia for the Asiatics," have

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encouraged the idea of independence from Europe. And then the Communists came along and agitated these people, promising to fulfill the desires which we had inspired.

These forces were working among the masses, and suddenly, right after the Second World War, all of them seemed to explode at once. In the last eleven years we have had a new world, of which most Americans are very dimly conscious — a world in which three fourths of the human race suddenly decided to march toward progress, toward better things, out of hunger up toward the prosperity that we have.

SMITH. Is there anything that we can do to help them in this march?

LAUBACH. Not only *can* we help them, but we *must* help them. They know that we have half of the world's wealth, and if we do not help them they will hate us. They will seize the hand of anybody who offers to help them. So if we help them with their agriculture, they will be our friends. If we help them with their health and with their economic conditions and especially with their education, they will love us. They know that they are hungry and destitute because they are ignorant. They know we have secrets that enable us to get ahead, whereas they lack those secrets, and so they stay down. Therefore, they want our secrets.

SMITH. Are you telling us that what they want primarily is not our food surplus — of which we have considerable — but they want instead something which will enable them to help themselves?

LAUBACH. Yes. They don't want to be paupers. They don't want to need charity. They want to come up. They won't settle for anything else. We ought to send them our surplus food and clothing as a stopgap, until we can do something more permanent for them. I believe in doing that, but it is not what they really want. They want to know why we have so much and they have so little. They want our secrets.

SMITH. Now this, I assume, is where your World Literacy program comes in. Is that right?

LAUBACH. Yes. Because as you can see very well, the beginning of this education that they demand and are clamoring for is literacy. They not only want this for their children; they also want it for themselves. So we must teach them to read as the very first step.

In all of these countries, at least 70 per cent of the people are illiterate; in some, illiteracy is as high as 90 per cent. A little fringe of 10 per cent at the top have the education. They have the money. They have the power. But there is not enough money to educate all the 90 per cent who are illiterate. They could not afford to build school buildings, or train and pay schoolteachers even for the children. But these adults who are on the march are saying, "Educate our children, but also educate us, and do it now. Or, if you don't, we will blow up!" Our American educational methods are not cheap enough for those backward areas. Indeed our own state governments are appealing for federal aid. Our highly expensive educational process is hopeless in countries with a high rate of illiteracy.

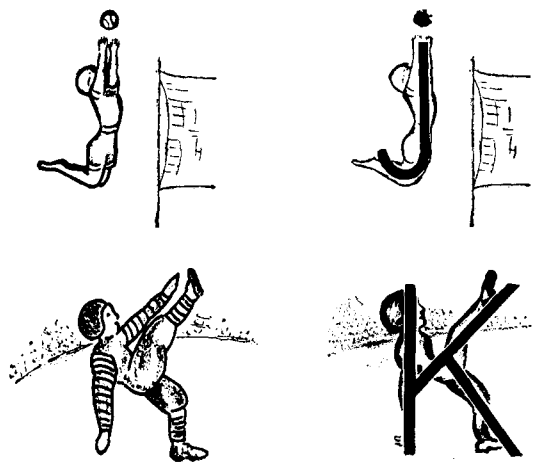
SMITH. So, a new method is required?

LAUBACH. Yes. We have got to prepare textbooks which can be taught by untrained teachers who are just barely able to read. We are making textbooks so easy to teach that the teachers do not need to go to school even for one year. If they can read our textbook, they can teach it to somebody else. The students get together and help one another. One of them knows a little more than the others, and he tells them what he knows. They can do that, you see, without any pay, and they can do it at home; so no school building is needed.

For the past twenty-five years, I have been traveling from one country to another, working with educators and missionaries and others, making lessons that are easy to teach. Would it interest you to see what those lessons look like?

SMITH. I think it would.

LAUBACH. I can show you one of them. This is a lesson in English.



We associate the sound of a letter with a word. "Jumping," for example. This man is jumping for a ball. He has his feet behind him. The hook on the letter "j" looks like his feet turned back. The ball over his head is the dot over "j." "Kicking" — this man has his leg high, kicking the football, and the letter "k" has its leg high up like the football player's.

By associating every letter with a picture, we teach the sounds of the letters. After that, we have



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a short story using these words. The book almost teaches itself, because we go from the known to the unknown by very short steps; from the known picture to the word, and from the word to the first sound. In that way we teach the phonetics of languages. It requires only four or five days for very phonetic languages. In other languages it takes ten or twenty days, depending upon the difficulties encountered.

SMITH. Then in the course of two weeks the people might begin to get a working, reading knowledge of their language?

LAUBACH. Yes. In most languages of the world there is only one sound for a letter. In our English language we have eight sounds for "a," and we have fifteen ways to pronounce "o." Our vowels are maddening chaos. I don't see how anybody learns English when he is grown up without going to a madhouse. But in those languages where there is only one sound for each vowel, the moment the people know all the sounds of the letters, they can pronounce any word in their language. Where I began this work, in Mindanao among the Moros, one of the Malay languages, called Maranaw, had only sixteen sounds, and we taught them in two days — eight sounds a day. Then the people could pronounce any word in the Maranaw language without ever making a mistake. That's more than anybody in the world can do in English, I think, because you never know what to do with a new vowel. In fact, I've never really decided how to pronounce my own name!

SMITH. What about the content of what you teach?

LAUBACH. As soon as they have learned these sounds, which is in a matter of days, we try to give them something that will be helpful in their everyday life struggle.

In India, for example, we have been coöperating with what is called the Community Development Project. The Indian government, with the help of American Point Four money, is training men to go out and improve conditions in the villages. I helped the government prepare lessons for those projects. We asked Indian and American experts, "What are you trying to tell the villagers? You know what they need, but they cannot understand your technical language. You tell us, and we'll write it down in simple language in a graded series, and thus we will get your knowledge across to them. We will be the bridge."

The health experts said, "Tell them they don't eat the right foods. When they eat a lopsided diet all the time, they are not strong and they are not well." So we say in our textbook, "Anand, the Wise Man, was wise because he learned to read. He knew what foods to eat in order to be strong."

SMITH. Anand is a man's name, isn't it?

LAUBACH. Yes. The name means "lucky." It's the most common name in India, equivalent to "John" in this country.

The first lesson that Anand read said, "You are not eating the right food." Then it told him what to eat; it says he began to eat that food and he got stronger.

In India, and all over the illiterate world, practically every illiterate has intestinal diseases like bacillary or amoebic dysentery. So the third lesson in our textbook says, "You are this way because the flies are contaminating your food. They breed out in the filth in the field, and then they fly onto your food, and their legs have these disease germs." It tells them, "Kill the flies with DDT; put it on the walls of your house; cover your food so that the flies can't get to it; cover your babies' mouths so flies cannot light on them. And bury the filth."

These illiterate people have no latrines, so the flies breed in the fields. The story says that Anand tried all this and took the medicine the book told him to take, and he and his whole village became free from dysentery. Today, as the villagers read these secrets, they say, "If Anand could do that, I can, too." Among many other diseases, I might mention one more that will make you smile. Everybody in the illiterate areas of the world is scratching. They have itch, and they don't know what to do about it. So Anand read in his book about itch. It said, "If you put gamaxene on your mat [they have no beds] and on your clothes and all over your body, the next day you won't scratch." Gamaxene cures the itch in a day.

Now, let us turn to agriculture. That's the greatest problem. Anand read in our textbook that the reason his land is not feeding him enough is that he does not feed his land; it is starving to death. In India there are millions of cattle, but the people burn their cow manure for fuel. The women and children make little cakes of cow manure, plaster them against a wall, let them dry, and then use them for cooking fuel. They have no wood and no oil and no gas; they have only cow manure for fuel to cook with. So this book says to Anand, "You should plant rapid-growing firewood along your irrigation canal, and then you should throw this manure, along with all the filth from the ground and all the leaves, into a compost pit, leave it there for three months, then put it on your land. Feed your land, and your land will feed you." Anand tried it, and you know very well what soil does when it is fertilized. The change is miraculous.

Then Anand read that you can get better seeds from the government — hybrid seeds of corn, wheat, and rice — and better fruit seedlings.



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So Anand goes to the government store and gets them. The crops are many times better. All the people in his village imitate him and get wonderful crops. Then Anand reads that the little wooden plow he has, which goes an inch into the ground some of the time and much of the time does not penetrate at all, should have an iron point on it. So he gets an iron point for his plow from the government, and it goes three inches into the soil and strikes virgin dirt that has never been turned over before.

Then Anand reads about "green" manure. There are many leguminous plants which put nitrogen into the soil, such as beans and alfalfa and clover. Anand does not read big words in the textbook, but he gets the ideas in very easy Hindi. Illiterate people need to apply only about five secrets of agriculture and they can raise just as much food on their land as we can on ours.

SMITH. And so the person reading this thinks, "If Anand can do it, I can." Is that right?

LAUBACH. Yes, that's it. When the expert comes to see the peasants who have read our secrets, he doesn't have to sell these modern ideas or explain them in his difficult vocabulary. He merely says, "What would you like me to do for you?" And they reply, "Get that iron point for our plows; help us get those better seeds; help us to crossbreed our cattle with those better breeds that we've read about." All the expert has to do is comply, and he gets exactly the results he wants. So what seemed nearly impossible becomes easy.

SMITH. What has been the response of governments to your program?

LAUBACH. Wonderful — and I will tell you the reason. The governments in the less developed parts of the world are not so afraid of Russia and China as we are. They are afraid of their own masses, because these masses are boiling with unrest and are threatening to overthrow the governments unless they do something to help the people out of their poverty. The masses clamor for literacy and basic secrets.

The governments are very anxious for a method that is cheap enough for them to be able to teach their many illiterates, and so the governments are coming after us to learn our "each one teach one" method. I have, myself, helped the ministries of education in sixty-two countries at their official invitations.

SMITH. You've actually done this in ninety-one countries; and in sixty-two of them you have had official status?

LAUBACH. Yes. I've been with missions and other private agencies in the other countries.

SMITH. Do you have any idea how many persons, perhaps, you have been helping by this?

LAUBACH. Well, this is only a "guesstimate." Nobody can contradict it because nobody knows for certain; a campaign like this gets out of hand and becomes almost impossible to count. About every day we get letters from some place we didn't know was using our method. At least 60 million have learned to read, perhaps 100 million.

SMITH. What could be done to facilitate a program like this?

LAUBACH. A tremendous lot could be done. You must realize that there are at least a billion adults who cannot write their own names, and a billion and a half who are unable to read books or newspapers. Our progress thus far is very small compared to the tremendous need. Our government is doing something, and literacy organizations are doing what they can. Governments in these countries would like us to establish schools like Literacy Village in India to train their village workers. Last year Literacy Village trained 800 people for the Indian government, and many more for the Gandhi Movement, UNESCO, Christian missions, and the Servants of India. Other countries want similar literacy schools to train their village workers to go out and supervise the "each one teach one" program, and to write books that will help their people.

One thing America can do is to send a very much larger number of people who are experts in literacy and simple journalism out where they are needed.

And then there's another thing that I hope will happen. A million American soldiers are stationed abroad. Why don't we start American troops who are in foreign lands teaching illiterates? Teach the servicemen how to use these books — they could learn in a week easily. They are now learning foreign languages. Then in their leisure hours have them put a book under their arm and go down the streets and say to somebody, "Would you like to learn to read?" These illiterate people would all go crazy with delight. It's wonderful to teach people, because they are so grateful!

Why, I ask, are we wasting the talents of young men in training for a war that must never happen? Why are we not using them in the war for these hungry multitudes who are making up their minds whether to come up by the know-how route or in a pathway of blood?



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In the weeks after I had passed fourteen, hardly a day went by in which my parents didn't remind me that soon I would be a refugee. The word became part of parental rhetoric in the house. I suspect now that my father and mother pronounced it so often in order to familiarize themselves with it — to develop, perhaps, some mental calluses against the word, or to domesticate it as one domesticates and warms, by frequent use and comfortable complaint, a frost-haunted idea such as Old Age.

But the word would not yield. For we were members of a condemned race in the Vienna of 1939. When my mother left for the hairdresser, or I for school, we always kissed each other without admitting why. Each time might be the last. We lived from breath to breath. The supreme sound in the world was the footstep on the stairs. Outside, in the fine spring sun, troops of apple-cheeked young men marched through the city and sang the Song of the Long Knives.

These dangers were bright and lethal and intimate. My father had been swallowed up by them and emerged again. But "refugee" was, for all of us, strangely beyond the imagination. I knew it had to do with being poor, with learning English and studying the mazed map of London. But none of these things plumbed the depth of the word. It became less fathomable the more quickly we approached it.

Our British visas arrived. The "Aryanization" of family properties was completed. My father decided to travel with my uncle and myself, and to let my mother and my aunt follow a few days later (the smaller the party, the less the danger). Clothing, books, dishes, the whole vocabulary of our daily existence, vanished into trunks. The great change was at hand.

It was barely dawn when my father, my uncle, and I walked to the taxi that would drive us out of our native street forever. Inside the cab my father slipped a heavy gold ring on my finger. The ring, I understood, had a sober purpose. As refugees in London we would have to live on what we brought, and we were permitted one piece of jewelry each. Yet the massive yellow band bedizened me. Its heavy gleam on my finger kindled the whole day into flamboyance. Our concierge, who must have discovered our departure after all, ran out of the house and to our surprise — for we had thought her sympathies uncertain — wept into a huge red-checkered handkerchief. A pebble hit the side of the car, an urchin's voice pelted us with "Drive 'em all the way to Palestine!", and as the taxi turned the corner and my childhood bumped out of view, my father covered our heads and prayed for a safe journey.

Abruptly the station seized us, all color and fever. Tiers of soldiers, helmets polished by the sun, marched to a train, singing. Song also came from a group of Hitler Youth with their black velvet shorts and snow-white shirts, entraining, I think, for a picnic in the Vienna Woods. Great garish posters pulsed down from the walls, and beyond the glass walls of the station, on the roof-

*Novelist and critic,* Frederic Morton *was born in Vienna, and now divides his time between New York and the Continent. His first book,* THE HOUND, *won him the Intercollegiate Literary Fellowship in 1947, and since then he has written two more novels,* THE DARKNESS BELOW *and* ASPHALT AND DESIRE.



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tops all about us, a hundred ebony swastikas on a hundred crimson flags flared and fountained in the breeze.

But I who stood in line with my father and my uncle; I who plucked at the tightness of my blue beret and who saw the officer with the death's-head visor at the end of the queue (*Judenpaesse* — Jews' Passports — it said above his desk); I who knew that such officers could give or withhold our traveling documents, could destroy, deliver, or — most usually — extort as they pleased; I, who was terribly afraid, didn't feel a bit like a refugee. I felt closer than ever to the city, curiously fascinated by its glittering menace. I had never been in so clear and shiny and frank a Vienna; I thought I understood for the first time its cobbly twists, its baroque flourishes, and the gargoyles crouching in its nooks.

I even saw my father with a definition drawn newly out of the pressure, the dazzle of that morning. In "peace time," as my parents had come to call the days before the *Anschluss*, he had been an abstracted pin-striped presence at the dinner table, and on Sunday a coffeehouse companion who would conscientiously debate soccer with his son before withdrawing behind newspapers to take "one glance at the situation" for the rest of the morning. Now, while we inched toward the Death's Head, my father was quite changed. His deep tan from outdoor work at Dachau had not yet faded. The seven weeks of starving there still pinched his jaw into bold angles. This, together with his shaven skull, gave him the profile of a Red Indian. He was the last person I would have expected to be touched by the gusts of James Fenimore Cooper, my great boyhood author. Yet here he loomed up next to me, gaunt, wild, even a little absurd, wearing the black *Loden* coat he had worn ever since he had brought it back from the Camp, and which he would not go without even now, in the July heat. He glanced carelessly at the station clock, and as he stepped up to the desk of the Death's Head and barked out in the prescribed Prussian manner our names, passport numbers, and destinations, I became, in the middle of my fear, astonished at something perverse, something oddly eager in my father's eyes.

The Death's Head listened with half-closed eyes. He pulled out a file, dozed over documents. With the lazy disgust of a man who decides to wave away a mosquito before slapping it, he remarked that we owed the Greater German Reich the sum of ninety thousand reichsmarks.

"Beg to point out, my tax clearance is here," my father said.

"You didn't hear me," the Death's Head said sleepily.

"Beg to report my family has been living on soup-kitchen tickets for the last ten weeks." My father produced three depleted ticket booklets. I had never been in a soup kitchen nor seen the booklets before, but I recognized the insignia of the Jewish Welfare Board on which my father had served for many years.

The Death's Head frowned at the evidence. His black sleeve swung toward my father's face. My uncle cried out, but my father stood straight and keen. The Death's Head marked a small *x* on his forehead. Then I felt crayon on my skin, and my uncle submitted to it. We were passed baggage. My father caught the sheaf of documents thrown at him, and suddenly we were running to get our train, tearing at our heavy bags; and while we heaved through the crowd and the engine blasted white impatience through the blue air, I heard my father's cackle. It was really a cackle, a prankster's giggle at having pulled a mad trick. It came out of a grimace that revealed in my father's mouth two front teeth whose length and wolfishness I had not previously noticed.

The sight and sound infected me. We scurried so ridiculously, we staggered so drunkenly with the heaviness of our bags. It was all so funny and crazy and desperate. And again I felt that this reeling of ours through the crowded platform, this tripping over valises and stumbling across children, was truer than all the sedate promenading we had done in Vienna; truer than the many days when we had been deferred to, flattered yet not tolerated, when lips had smiled yet curled all around us. All those "peace years" had been polite fake. They had to be sat through as rough boys have to sit through the last school hour. Now the bell had rung release. The city came down on us, one giant and garlanded bully. And we ran for our lives with the exhilaration of our pursuers; we ran those last few yards of native soil in mischievous hysteria, pulling and panting, scrambling through farewell wishings and raised-hand hailings, through jeers and jokes and through the throwing of a tomato that splattered the suitcase of my father just as we climbed the platform of a third-class carriage.

THERE we rested. The palpitation of my heart became the palpitation of the wheels. For a moment I wondered if I shouldn't be conscious of being a refugee now. Vienna was rolling away underneath. Tomorrow, if all went well, we would step out of the train into a fresh universe. Still I could summon no solemn sense of metamorphosis or liberation.

I was glad when my father beckoned and the heavy suitcase handle yanked me back into his



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frantic spoof. It seemed logical, it was excellent, that instead of wiping away the tomato splotch he should put out a tasting finger. And after we had toiled our luggage across a giddy connection bridge onto a carpeted corridor, it seemed right that the first-class conductor should wear spectacles of an immense steel-rimmed dignity ill-supported by a clownish pygmy of a pink nose. He threw his head back in anger and asked what we thought we were doing. With another head toss he refuted my father's tickets: we had no reservations; the whole matter was typically disorderly ("typically" in such cases always referred to our race); we had better report to the trainmaster.

And then it seemed quite natural that my father should affect obedience — that he should lead us slowly in the direction of the conductorial forefinger until the pink pygmy nose was out of sight, and that he should then, suddenly, with another cackle, swerve into a first-class compartment where sat a one-eyed Major of the Wehrmacht.

My father brought his heels together, bowed, rapped out "Permission?"

The Major turned his head slowly from the book he was reading. I remember him well. His peaked cap lengthened his long head and conspired with his long, flat nostrils to suggest a pale and precise stallion. His black patch made him look like one of those piebalds that are spotted over one eye. He took us in for two full seconds. He didn't say a word. His head began to move back to the book again, but just when I considered ourselves cast out, his hand reached for the wine bottle in the middle of the compartment table and pulled it back toward his side. We were admitted.

My father clicked "Thank you." My uncle and I stowed luggage. And as soon as we were ensconced the door burst open with the conductor's indignation. "This is incredible!"

"We have the Herr Major's permission," my father said politely, securing a loose window shade.

"Really!" said the conductor. The Major, deaf, read his book and sipped his wine. The conductor cleared his throat officially. Perhaps to gain time, he asked for the ticket of the Herr Offizier. The Major reached promptly into his coat pocket and with a small thud unfolded his billet. An instant later my father presented our tickets with the same promptness and unfolded them with an identical thud. The exact repetition created a mirage of solidarity between the Major and my father. It reduced the conductor to a sardonic "*Ja so?*" The bite of his puncher into our tickets intended viciousness but sounded impotent, like a foot stamp. He didn't counterattack until he strutted out, and then only with a long, sardonically drawn out "*Interessant!*" which intimated that the matter was far from settled.

Today you may find cunning in my father's behavior. For us then it was sheer sudden mania, yet a madness wonderfully armed against the madness all around us. He sat on the scarlet plush in his black coat. More than ever he looked like a stoic, savage Cherokee. The unreason that lived in his eyes was like a talisman to us. He proposed we practice English. My uncle began to drill me in auxiliary verbs. The mystery of "refugee" rose as usual out of the print-smell of my primer. But it couldn't fasten on my mind though with each bend of the Danube the known world fell still further behind. The stampede of landscapes seemed as insubstantial as the conjugation of "I am," "I can," "I have." Only the bright cushions of our coupé were real. I felt snug among its prodigies and perils.

And so Upper Austria floated away in green waves toward the horizon. The sun crawled up the window like a fabulous insect. I became hungry. I watched the wine level dropping in the bottle of the one-eyed Major who read and sipped, silent and steady, one knee folded neat above the other, the book held before his face like a mask, half Buddha, half spotted horse. I had a marvelous sense of closeness with whatever was to come.

The Bavarian hills welled up, subsided. In Franconia the dining-room steward wove chanting through the length of the train. The officer rose to an unsuspected height, deposited his cap, disclosed crushed blond curls, and, walking out, compressed himself into what seemed not only a stoop but a bow. I was hungry; I resented so prosaic a need in the middle of the dark wonders of our voyage. But I was so hungry. I watched everybody stream past our compartment toward the sign that ornamented the diner entrance at the end of the car. The sign said, with beautifully curlicued gothic letters, JEWS FORBIDDEN. A candy vendor shouted his way through the aisle. My heart hoped, my stomach prayed, my father was already poised. But the conductor materialized, whispered into the vendor's ears, pointed at us through the glass door. The vendor went on.

And then the train pulled into Nuremberg. "Watch," my father said. He pulled the curtain down the door. And before I saw how, he had put on the Major's cap and greatcoat. Again it wasn't the foolhardiness of his action that struck me, but the fact that this grinning desperado, who even took time out to mock the goose step, had once been my pin-striped "peace time" father. A moment later he leaned out of the window with a Prussian thrust, waving a bill and bellowing at platform concessionaires. Then the Major's cap



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and greatcoat were in place again and we had six steaming sausages, six hunks of black bread, and six mounds of mustard, and were munching away.

By the time the Major returned I was once more lazing over English participles. He rolled the door open with such a bang that I sat up in terror. I thought our bootlegged feast had been discovered. But the Major, as if to make up for his explosive entrance, resumed his seat in silence and with a curious stiff gravity. He placed a white paper bag on the table, for some reason closer to me than to himself. He had also brought a new wine bottle, already half empty and growing emptier still as he took stately sips. He fixed me, *me* specifically, with his concentrated glance, and then sank back and appeared to fall asleep.

But I didn't believe him. I didn't like the way he had stared at me. His middle finger kept tapping slowly against his knee. I had the shuddery intuition that the moment his "good" eye had closed, the other one had started to see. The black eye-patch became a huge fierce pupil which drilled right through my skin. I tried to escape. But no matter in which direction I twisted, his head seemed to follow me. I tried to find refuge in the window. The gingerbread scenery of Franconia hastened away from a livid sunset, much too busy to give me relief. My father sat stoic and soundless. My uncle didn't rescue me with a grammatical challenge though we hadn't yet covered irregular verbs. The compartment grew dusky to the wheels' metallic, monotonous excitement. I was delivered to the persecution of the Cyclopean eye. And then the other eye sprung alive, as I'd known it would. The officer impaled me on his single prong, said in a high-pitched North German accent:

"A young man who lets his ice cream melt is nothing but a brat."

I was stunned. My father, though, snapped to. He lifted a big soggy ice-cream cup out of the white bag.

"Eat the ice cream the Herr Major brought!"

"A wooden spoon is attached for the convenience of our young wastrel," the Major said bitterly at the liquid mess.

I used the spoon. I ate. With the mono-glance still leveled at me, I tasted no flavor, only wetness. I licked steadily while the Major, ceremonious and somnambulistic, his visible lid closed, took sip after sip. It was the most fathomless ice-cream cup I have ever encountered.

"Opportunities must be taken to the fullest," the Major said, a shade less implacable, "especially by people who need them."

"Yes, sir," my father said.

"Our side is taking *our* opportunity to the fullest."

"Yes, sir."

"I therefore expect the other side to take its opportunity to the fullest."

"Yes, sir."

"Then there can be fairness. Because fairness is possible."

"Yes, sir."

All of a sudden the Major stood up. "One can drink to that!" He reached behind him into a leather bag, and with three categorical gestures produced three glasses for us.

"I am entitled to drink to that with intelligent persons no matter who," he said, icy, to an invisible heckler, poured the last of the bottle into the new glasses, and threw it, with a fine shocking curve, into the streets of Frankfurt that had begun to flank us.

"A toast to fairness," he said, lifting his glass.

"Thank you, sir," my father said, and imitated him along with my uncle.

"No one is too young to lift his glass to that!" the Major thundered, for the childhood taboo against "intoxicants" had made me hesitate for a second.

"We have the honor to toast fairness!" the Major proclaimed from his impressive altitude. "To decency! To honest opportunities! To no hard feelings!"

With each exclamation his arm rose higher. It must have been a strange spectacle, our disparate foursome performing a rite in a side-shaking coupé. I didn't see its end because I closed my eyes before the unknown impact of alcohol.

Something formidably tart bit my mouth and stung me. At the same time the train jumped to a halt. Perhaps the Major's glass was jolted out of his hand, perhaps he threw it down to observe the custom. At any rate there was a silver splintering, a great shouting of "Frankfurt!", a banging of doors and a wildness of porters, and almost instantly the evening sagged soft, heavy, wayward, into my life's first tipsiness. The hours that followed held danger and significance, but I can't give a responsible account of them since my own experience didn't happen to me but disported itself at a certain frivolous distance in the form of errant masks and jumbled pageants.

A gnome-like orderly, for example, flashed up and vanished with all the Major's belongings and, so it appeared, with even the Major himself on his back. A big woman with a fur piece gaped and dissolved. The conductor came, his puncher gnashing at our tickets; a horde of other travelers, tramping, intruding, disintegrating — and then nothing. The clatter of wheels again, like distant



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hoofs in the abrupt night, blackness, and my father huddled in the shadow of his *Loden* coat; a huge jagged ghost afloat in the dark, probably the Cathedral in Cologne. Resumption of darkness, of the hoofs, and — of a sudden — our coupé blinding bright, littered with the contents of our luggage, and a man with a gray uniform and a red mustache grubbing into our bags like a mole, plowing up heaps of trousers, shirts, soaps, books. The conductor leaning by the door, his glasses aglint and agloat. And the conductor leaping to hold up a little jewel box. Here my memory comes alive with sound. The Red Mustache, a portentous bass, blared that the smuggling of jewels by Jews meant automatic arrest, forfeiture of passports. My father had to fish out a key. The little box snapped open. An Iron Cross lay on blue velvet. My father cackled a cough, explained that this was his cousin's decoration, awarded posthumously during the Great War, for heroic resistance against the Russians. He begged permission to take it with him. The Red Mustache became thoughtful even though there was no such cousin. And the cross looked like one of the many medals my father had produced at his plant. While my thoughts floundered over such contradictions, the Red Mustache was succeeded by a pink-cheeked man in a green uniform. The train rolled again. My father pulled down the door shade, took out his jackknife, and scratched into the Iron Cross a crevice of laughing gold. And only then did I realize that my father had perpetrated another grotesque hoax — and that we had done it, we had passed the border, we had actually passed the German border, we were in Holland. Now we must truly be refugees.

During the rest of the journey my lame brain wrestled with that realization. I recall mistily that the electric luggage van on the Hook of Holland transferred not only our bags but also myself, and that this caused amusement around me. Later, on the boat, the salted Channel wind blew some alertness into my mind, but I still couldn't focus on a sense of relaxation or relief or of entering a new existence. On the contrary, the highly varnished blue-gold dome of the summer sea-morning closed over my head with a resonant chaos remarkably like the oceanic station hall in Vienna of the day before. The same sun which had glittered on the swastikas now bounced off the white lifeboats of the ferry. The world swung above whitecaps, dipped below gull cries. Loudspeakers chorused "Roll Out the Barrel . . ." Floods of French tourists clattered and chattered down on us. They screamed with each pitch of the boat, as on a roller coaster in an amusement park, and asked my father (my uncle being busily seasick) to snap them against life preservers. My father complied. Then he anchored himself on a valise, watchful as ever in his *Loden*, waiting.

Waiting for what? For the soil of England, which felt gratifyingly solid but no different from the one we had fled? For the old lady in the train compartment, who knitted black wool and whose pensive pale-nosed silence created in my groggy mind the mad fancy that she was making an extra eye-patch for the Major? For the unending succession of red roofs and green hedges which hypnotized me to sleep again? London's dun-colored clangor which burst my eyelids open? The taxi that brought us through a hazy, veering street hive to the flat my uncle's "contact" had secured for us? Or for the room into which we were finally led by a seventeen-year-old girl with a pink strap falling down her bare arm?

My father had, of course, been waiting for that room. We all had. That room triumphed over my hangover. It swept aside even the pink strap which, to my fourteen-year-old sheltered self, was an enormity. The room contained, even if it didn't immediately offer, the final truth of our journey.

It was a huge room. "A suitable two-fam'ly room," as the girl said, waving at the curtain that ran through the middle. It was a room into which, she promised, "the Mum" would enter in a moment to greet us. It was a room dark, low, breathtakingly dusty. Dust festooned the paper lampshades with its flakes; dust made the sunken armchairs look like scaly hippos; dust covered the unwashed dishes in the sink and hung from the wall phone. Dust slept on the room's lumpy landscape like snow and lent it the air and mood of dream. The room was in many ways the most startling marvel of our trip.

My father took one of the slipcovers that lay, for some reason, stripped next to an easy chair and applied it against a wall. A small avalanche of flakes fell; a white spot showed up. My father, abstracted, produced white spots all over the wall. From corner to corner he walked, poising the slipcover. My uncle and I watched him and strolled tranced among the furniture like sightseers among famous ruins.

And then "the Mum" came down on us. She screamed even before she entered, as if she had just been violated in the hallway. She was a ruddy, chunky creature with a florid badge-of-office housecoat that swarmed behind her as she ran up to the slipcover my father had used. She picked up the dust-smudged cloth to cry "My best! If it isn't my best! *Ja!*" Against the gray dunes of the room she stood like a pagan priestess



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in her purple gown, holding the smudged slipcover aloft with one flaring sleeve, pointing with the other in declamatory pantomime at a number of objects and pouring out geysers of what sounded to me like a forgotten heathen language.

And not until she strode away in a ferocious hiss of skirts, not until she removed the key from the door with a mighty yank and streamed out of sight and down the stairs with a rumble and a mutter, not till then did I understand what she had meant. She had meant that she had given us her foremost, her largest room; the one, as she had pointed out, with the extension phone on the wall here; the one with the hassock there; the one with these, her best slipcovers, which she had been about to put on the chairs. And we had befouled her offering by befouling her slipcovers. We had ruined them beyond bleaching. And she had made them herself. Not if she were down to her last farthing did she want to be dependent on such guests. We were finished. We were evicted before we moved in.

We stood dazed in the dusk of the room. My father whispered. He held an accounting consultation with my uncle, of which the conclusion was that an "adjustment" would be cheaper than finding a new place by means of a new taxi. He held a spelling consultation with my uncle, and on one of the parchment envelopes from our escritoire wrote FOR DAMAGES. Into it he folded a ten-shilling bill. Cackling again, he gave it to me together with a clap on the shoulder.

"Give it to her," he said.

And I went forth with a certain goose-pimpled keenness. I wonder now if I wasn't hoarding my goose-pimples. Perhaps I had already discovered that terror successfully survived becomes adventure, and that all our Nazi suffering would someday become an unadmitted treasure. I do remember stepping down the stair carpet, whose mousy gentility was rained on by chipped plaster from the wall, and I remember listening with curious contentment to each gaudy squeak my footsteps made, smelling the sweetish stale scent the whole house exhaled at each pressure of my foot as though it were one gigantic and mildewed perfume atomizer. At the first landing I met the girl, her strap brash as ever. I hid my piquant paralysis behind a lack of language. "Mum?" I asked, indicating curves of housecoat. She gestured back: thumbed downward and raised two exquisite and slightly soiled fingers. I thanked her with an almost Continental bow and went down for two more stories until I reached an open door.

Behind it, talking into a telephone, was "the Mum." From the wrought-up cascades of her gown I knew she was speaking to my father. One nod of hers at my envelope brought me inside the hall and had me deposit my burden on a table next to a sleeping cat as dusty as anything else in the house. Another nod dismissed me.

And so I walked upstairs again. This time I didn't have to cope with a pink strap. But suddenly I became aware of sounds which I had heard but not understood on my way down — the code, the language, new to me, of a building with thin walls. Coughs, groans, passions, secrets, even boredoms rode the air. And it seemed to me, climbing through the many-tongued twilight of the staircase, that I had been traveling the whole past day through a long tunnel that began at our house in Vienna, and along whose windings there still stirred in niches the Death's Head with the crayon, the bespectacled conductor, the one-eyed Major, the customs-inspector mole, the Frenchmen on the boat crying "*Voulez-vous* . . .", the English lady knitting a black silence — a tunnel that finally widened into the musky murmurous grotto of this London house and ended before the askew bronze knocker and mottled green paint of a door.

I opened the door. I entered our room again. And the moment I did, our whole journey fell away from me. The tunnel died. I saw that we were staying. My uncle was unpacking. We had been pardoned by "the Mum," we had arrived. My father was washing dishes in the sink. He actually washed dishes, and it was a heartbreakingly small and mean action for a man who had done such deeds on our voyage. Yet here he was, his black *Loden* coat doffed, his Red Indian self dead-crumpled on a sooty chair. He stood bent behind the sink, fumbling wetly.

And I believed it. I saw, for the first time, that my father's hair was beginning to grow back except for a bald spot in the middle. I saw it because the electricity had been turned on, a weak watery yellow that drizzled down from a nude light bulb — a light that rinsed fantasy from all the dust and left only its drabness. I saw tacked on the coarse wood of the dresser the address of the Rescue Committee where my father and my uncle would go tomorrow in the hopes of finding a job. I heard the vast impassive roar of the foreign city all around us, and I stood still, barely beyond the threshold of the room. I put my hands in my pockets because I felt so frozen. I believed it all, and my heart shivered as your heart shivers when you must leave the theater after the show and walk in the hard cold streets that you must live in, must believe in all the days of your life. The magic and the madness were over.

I took my hands out of my pockets and stripped off the gold ring even before being asked. I knew the ring would have to be sold. It had come upon us. I was a refugee.



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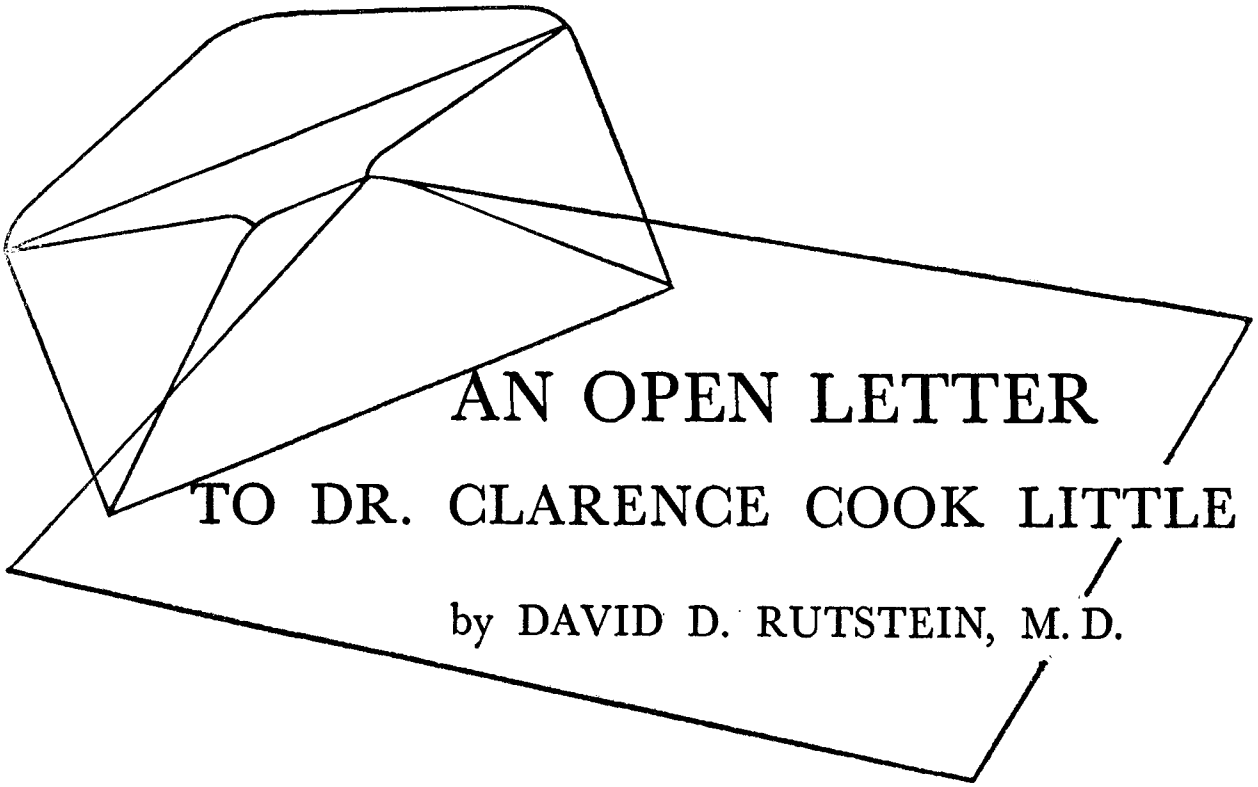

# AN OPEN LETTER TO DR. CLARENCE COOK LITTLE

by DAVID D. RUTSTEIN, M. D.

*Is there tangible evidence of a relationship between cigarette smoking and lung cancer? Eighteen studies conducted in five countries have shown that there is, but Dr. Clarence Cook Little, chairman of the Scientific Advisory Board to the Tobacco Industry Research Committee, asserts that three years of research by his group have "produced no evidence that cigarette smoking or other tobacco use contributes to the origin of lung cancer."* DR. DAVID D. RUTSTEIN *is head of the Preventive Medicine Department at the Harvard Medical School.*

DEAR DR. LITTLE:

As a professor of preventive medicine, I have been deeply concerned, as I know you have, by the constantly increasing death rate from lung cancer in the United States and in other parts of the world. Over 25,000 people in the United States die from lung cancer each year, and the number is increasing by about 2000 every year. This disease now kills more men than any other form of cancer.

What is the evidence that cigarette smoking is responsible for most of this increase? Eighteen studies in five countries show either that patients with lung cancer are predominantly cigarette smokers, or that cigarette smokers have more lung cancer than do non-smokers. All but one of these eighteen studies show that the more and the longer you smoke cigarettes (but not pipes and cigars), the more likely you are to get lung cancer. Depending on the amount and duration of the smoking, the rate of occurrence of lung cancer is from five to thirty-five times greater among cigarette smokers than among non-smokers. Most important, in all of the medical literature there is not one study which shows no relationship between cigarette smoking and lung cancer. These results, it seems to me, are more than just "the opinion of a few statisticians," as you stated on last July 12.

There is another kind of evidence which links cigarette smoking to the development of lung cancer. Examination of the lungs of cigarette smokers under the microscope reveals precancerous changes. The extent of these abnormalities is directly proportional to the amount and duration of cigarette smoking. These changes were least common in the lungs of those who did not smoke cigarettes regularly and most common in the lungs of those dying of lung cancer.

There is a third but very weak kind of evidence which should be mentioned for completeness. Substances have been found in cigarette smoke which are similar in their chemical structure to compounds which produce cancer in animals. Actually, a few investigators have been able to



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produce cancerous changes following application of such substances to the skin of mice. As a cancer research worker of many years experience, you know that evidence obtained on animals cannot be translated directly to man. You know that conclusive evidence on human lung cancer has to be obtained from observations on man. At present, therefore, these positive results in animal experiments add little to our understanding of human lung cancer.

You have consistently ignored or brushed off all of the human evidence whenever a statement relating cigarette smoking and lung cancer has been released to the press by a research worker, by the British government through its Medical Research Council, or by the Surgeon General of the United States Public Health Service speaking for the United States government. You have stated that there is nothing new, that the evidence is merely "statistical," and that no "cause and effect relationship has been demonstrated." Your statement troubles me because I had always thought that such evidence *is* valid; I had been taught to believe that it is essential for medical research workers to follow statistical principles in all their investigations. What is wrong with a statistical study? Do not statistical principles come into play whenever anything is counted in any scientific study, whether performed in the laboratory or in the field? Statistics are, after all, the rules by which things are counted, and it is impossible to do any experiment without counting up the results.

I don't know exactly what you mean by "cause." When you question the eighteen studies which show a relationship between cigarette smoking and lung cancer as being only "statistical," I think what you really mean is that these studies are not as well controlled as laboratory experiments. If we think about it, we realize that even in laboratory experiments, no matter how performed, the results are really nothing more than a statistical association between two events. The laboratory result becomes more valid if one can perform a series of experiments in sequence, because one can frequently rule out factors which may interfere with its interpretation.

On the other hand, in the study of epidemics of disease as they occur in a population, one can only observe what actually happens. This is as true for epidemics of influenza as it is for the present epidemic of lung cancer. This limitation does not deny the validity of the epidemiologic observation; it merely demands more care in interpretation. It requires analysis of the plan and results of each study and a comparison of the data of many studies planned along different lines. In the case of cigarette smoking and lung cancer, one may get some reassurance from the unanimity of results from the many different approaches that were used in the eighteen studies. It is unlikely that all would have been affected in exactly the same way by extraneous factors. Moreover, these results are confirmed by the increase in precancerous lesions in the lungs of smokers.

In spite of possible limitations of the method of study, the control of many human plagues in the past has depended solely on the kind of information which you have criticized as being only "statistical." This was certainly true before the discovery of bacteria by Pasteur about 1860. Let's look at the record and see how it applies to the present situation.

In 1796, when Jenner recommended vaccination with cowpox for protection against smallpox, he did not know the "cause" of smallpox. He knew only that milkmaids who previously had cowpox had immunity against smallpox. This was purely a statistical association. The virus of smallpox was not discovered until the early 1900s — over a century after the disease had been brought under control in civilized countries. Would you have recommended that vaccination against this highly fatal and widespread disease should have been delayed for a century because the evidence for it was only "statistical" and because Jenner had not discovered the "cause" of the disease?

Again, in 1854, during an epidemic of cholera in London, John Snow recognized the statistical association between cases of cholera and the drinking of water supplied by one of London's many water companies. John Snow inferred from his observations that a noxious substance causing cholera must have been transmitted by the particular water company, although the "cause" of cholera was not to be clearly defined for another forty years. Would you have said that the recommendations of John Snow were not to be applied in London because he did not know the "cause" of cholera? Perhaps one cannot apply the same rules to cigarettes as one does to germs. But the Southwark and Vauxhall Company, which pumped the sewage of the Thames through its private water supply, was probably disturbed by the charge that its water was responsible for the cholera epidemic.

Other diseases, such as rabies in Scandinavia, have also been controlled without information as to "cause." Unfortunately the opposite is also true. For example, typhoid fever in Devonshire could have been prevented if Dr. William Budd's epidemiological observations had not been ridiculed by the clinicians of his time.

Remember, Dr. Little, I am not recommending that people be forbidden to smoke cigarettes. Fortunately, our citizens can make their own deci-

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sions about matters such as these. But in a democracy, citizens have the right to be given the facts. They also must be protected by their government, as they were in a recent statement by the Surgeon General of the United States Public Health Service, against a smoke screen of irrelevant and confusing details.

In objecting to a public health program to diminish lung cancer by urging a decrease in cigarette smoking, you referred on July 12 to "variables in human habits, environmental and constitutional, such as biologic susceptibility to cancer, the effects of previous lung disease, hormonal influences and many other factors." These influences, as well as air pollution, are undoubtedly of some importance. But what do they have to do with the facts that the large majority of cases of lung cancer occur in cigarette smokers, that the longer and the more the individual smokes the more likely he is to have lung cancer, and that smokers have precancerous lesions in their lungs?

Actually, the evidence for the association between cigarette smoking and lung cancer is stronger than Jenner's evidence when he recommended vaccination against smallpox. This association is as strong as the basis for John Snow's recommendations for the control of cholera in London. Why do you insist that we find the "cause" of lung cancer before public health authorities be permitted to make any effort to control this disease?

I agree with you that further research must be carried on as intensively as possible so that we may completely control lung cancer and so that smokers can inhale their cigarettes in complete safety. At the same time, our citizens must be told clearly of the present risk of smoking any of the filtered or non-filtered cigarettes now available. But we must go even further. We must not limit our research on cigarette smoking to its relationship to lung cancer. As far back as 1938, Raymond Pearl of Johns Hopkins showed that non-smokers lived longer than smokers. Since that time, increasing evidence has been accumulating that other diseases, particularly coronary heart disease in young men, may be more common among cigarette smokers than among non-smokers. It will be important to confirm or deny such relationships because a small increase in a very common illness like coronary disease may cause many deaths. And the people must be allowed to know.

The Tobacco Industry Research Committee is to be complimented on the large sum it has allocated for research on the relationship of smoking to lung cancer. This enlightened approach seems inconsistent with the committee's policy of blind opposition to any attempt at public health control of lung cancer. Shouldn't this committee take a cue from the experience of the liquor industry after Prohibition and at least counsel moderation in smoking?

Although I realize that your committee does not perform research, with your leadership it could aid in setting up an experiment to answer the crucial question: Will a decrease in cigarette smoking result in a concomitant decrease in the death rate from lung cancer? I am optimistic enough to believe that a study could be set up to answer this question. Volunteers could be randomly divided into two groups — one being urged to stop and the other to continue cigarette smoking. There will probably be enough difference in the smoking habits of the two groups to measure possible differences in the death rate from lung cancer.

The results of such an experiment would provide the basis for a continued public health program. The laboratory research on the basic mechanism of the disease would, of course, meanwhile be carried on.

In the meantime, Dr. Little, is there really any justification for your continuing to demand the discovery of the "cause" of lung cancer before we attempt to save human lives by recommending a decrease in cigarette smoking? Lung cancer is a serious disease which causes much suffering and cuts down people in the prime of life. Should not public health authorities immediately recommend the obvious remedy suggested by sound epidemiologic observation and confirmatory laboratory evidence? If not, why not?

DAVID D. RUTSTEIN, M.D



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# THE HELLENIC WORLD

## BY LEAH BODINE DRAKE

The Hellenic world emerges in our dream half history, half fable.
How the great names rise, passionless as marble, bathed in cloudless noon!
Plato, Leonidas, Pericles, Phidias, Homer —
strained by time of all color and turmoil into the white simplicity of stone.

The Hellenic world . . . the Helios-hour of man,
when man lived in the here-and-now,
and heart and mind, meeting in equilibrium, drew order out of chaos,
giving the western world its darling dream:
we are the heirs, we boast, of marble men.

And the men were shaped by their land and its marvelous light,
a land saturated with light, where the rocks give light back
in floods of laurel, myrtle, ilex, pine,
and the sea tosses light back into the wind as if blue wells of fire
fountained beneath the waves.
A country defined by its own form and texture —
horizons intimate and lacking mystery,
bony hills, dry plains sparkling like goldstone, savage brooks
whose little journeys the eye can follow in a glance,
thrusting headlands whose naked stones make pedestals for the column of natural man.
That earth blossomed in man's image:
rivers tangled the pale hair of naiads among their cresses,
bay leaves rustled on the feet of dryads, goats played on pipes.
Even the gods were hardly more than men, coming down from their accessible heavens
to mate with herdboys and kings' daughters in water gap and fuming cave,
amazed and ravished as any mortal by their world's wonder.
The gods' houses stayed close to their worshipers, rooted like trees
in the common soil — even the Parthenon, synthesis of body and mind made visible,
keeps, in its marble posts, the shape and sturdiness of oaks.



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We forget now that the marble cast a shadow: we forget
the painted boys, the treadmill slaves, the oracles
with their glib puns and shoddy miracles.
We remember only the cities blond as honey among holy olives,
caryatids poised like jonquils on the shrines,
calm foreheads of philosophers.
We forget the haggling on the wharves, the quicksilver lying.
We remember only the horse-wild helms of heroes.

But how can we claim descent from these people of high noon?
They turned their backs on all that dazzle us —
antiquity, the faraway, the sky, the dissonances of personality.
We are soul-probers, star-mappers, wood-walkers, scalers of Everests,
pursuers of tomorrow and tomorrow and tomorrow:
how can we understand a people without clocks?

They were sailors, but of narrow seas,
poets, for ages without an alphabet,
artists, whose pigments had no green,
seekers of truth, to whom the mask was all the man,
masters of numbers, without zero —
(for how could Nothing take a sculptured shape?)

How can we know them, whose word for *slave* was *thing?*

O lost Hellenic world, small steady sun around which civilizations circle!
Your way was not our way nor your day our past.
To us, the children of the gothic woods, cold fogs and yearning spires,
you are our darling dream, our marble fable!
And from this raveling age, when the ground you stood so firm upon
trembles in all its atoms at our feet,
we send our thanks to you, for what we never could create and barely understand:
the white honey of your broken comb
caught in the bronze fingers of a charioteer,
in the rondure of a cup unearthed at Delos,
in scattered Sapphic lines. . . .

We are not your sons, only your lovers.



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*A New Englander who was educated at the University of Notre Dame,* EDWIN O'CONNOR *does his writing in the winter on Beacon Hill and in the summer at Wellfleet. His novel,* THE LAST HURRAH, *one of the most widely read books of 1956, is now being filmed, and his new book,* BENJY, *a Ferocious Fairy Tale, will be off press this month.*

# A GRAND DAY FOR MR. GARVEY

***by EDWIN O'CONNOR***

AT FIRST, old Mr. Garvey had deeply resented the indignity of being shipped off to the home, and more, of being shipped there by his own flesh and blood. He was not a man in whom family feeling ran strong, but he had his pride, and the thought of being abandoned to an institution at his time of life, merely because his niece and her husband had found an old man's presence in their home a bit inconvenient, was so mortifying that he almost wept in his helplessness. As soon as he arrived at his new quarters he slumped into a chair in his neat little room and spent the day staring with miserable eyes at the holy picture above the bed, and raging at the inhuman behavior that had transferred him to this.

"Cold as stones, the pair of them," he groaned. "An old man like me, packed off like a sheep — oh, the *shame* of it!"

Yet after a week at the home, Mr. Garvey found it to be much more congenial; after a month, he admitted — though only to himself — that he had never been so well off. The house was a great shambling stone structure, built years ago as the country refuge of a celebrated dealer in narcotics, and now, in these days of burdensome taxation, the property of the Church. It was handsomely located in the Berkshire region of Massachusetts, and from his window Mr. Garvey could look down each day upon the loveliest countryside in New England.

If the beauty of the prospect affected Mr. Garvey only mildly — he had never been much of a man for what his niece liked to call The Good Green Land — the concrete fact of his personal liberty positively delighted him. Now, for the first time in years, and within certain quite comfortable limitations, he was the master of his fate.

Life with Ellen and the man whom Mr. Garvey preferred to think of simply as "the husband" had been a series of tense, unwitting violations of the little proprieties — the legitimate rumbling of the stomach after a big meal, the shoes slid off for greater ease, the discreet employment of the toothpick — and he had always been conscious of a variety of impatient reactions: Ellen's half-stifled sighs, the irritable rattling of the husband's evening paper, the silent, solid conspiracy of exasperated glances.

And now there was no more of that, for generally speaking he was let alone. When the door of his room was open he could see an occasional white-clad nun walking swiftly and noiselessly down the great immaculate hallway. Mr. Garvey liked the nuns; he found them courteous and disposed to mind their business. As they passed, sometimes they looked in and said, "Good morning, Mr. Garvey, aren't you looking well today!" And then they moved along, leaving him free to read his few books, to listen to his radio — and this had come to be the greatest of his new-found pleasures: daily he listened, fascinated, to the melancholy progress of the afternoon domestic dramas — or perhaps, in the rare intervals when he felt the need of companionship, to wander about the building, engaging in heartening snatches of acrimonious dispute with his elderly fellow residents. All in all, thought Mr. Garvey comfortably, it was a grand way to live, especially



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when a man was, like himself, rather close to the end of the rope.

Mr. Garvey's room faced the southwest — this was a luxury, but the husband, in his eagerness to part with Mr. Garvey, had not balked at the slight additional expense — and on the good days was filled for hours on end with the warm sunshine so welcome to old bones. But it was as an observation post that the room had its greatest advantage: from it Mr. Garvey could see every inch of the gravel drive which led from the highway into the grounds. This was most important, for each Thursday afternoon his niece rode in to pay her weekly call of duty, and Mr. Garvey liked to be thoroughly prepared for her arrival. His niece was his only visitor, and he both regretted and enjoyed her coming. On the one hand, it was invariably inopportune, occurring just as he was listening to "Pepper Young"; on the other, it gave him the opportunity of playing the little game which he had spent so much time devising.

On this Thursday, his niece arrived somewhat earlier than usual; Mr. Garvey examined her dispassionately from above as she stepped briskly toward the front entrance. He thought once more that she was really quite a homely woman indeed. Then he hurried to his chair and, with a little thrill of anticipation, prepared to welcome her.

When she came in, he was sunk deep in the chair, breathing noisily, his mouth open, his eyes closed.

His niece halted and said, tentatively, "Uncle Martin?"

Mr. Garvey twisted, muttered, and blinked his eyes half open. "What is it now?" he asked wearily. "What is it this time?" Then, blinking again, he said with an air of discovery, "Ah. Ellen. It's you. I thought 'twas *them* again."

The "them" was good, a nice preliminary touch. Without being a specific complaint against authority, it was at once accusing and forlorn, and Mr. Garvey was not a little disappointed that his niece failed utterly to respond to it.

"I wasn't quite sure whether you were sleeping or not, Uncle Martin," she said, crossing the room and kissing him lightly on the forehead. "I hope I didn't wake you."

Mr. Garvey gave her a sad little smile. "I don't mind gettin' woke up," he said gently. "I get woke up a lot around here. I don't mind at all." He regarded his niece mournfully. "You look good," he said.

"I feel well, Uncle Martin, thank you."

"And the husband?"

She smiled brightly. "You mean Arthur, of course, Uncle Martin. Yes, he's fine too; he asked me to give you his very best."

"Ah. Well well. And how are things," he asked suddenly, "out in The World?"

She laughed. "I'm sure you'd know much more about that than I would, Uncle Martin. I seldom listen to the radio these days and I don't think I've read a paper for weeks. Honestly, I just don't know where the time goes!"

Mr. Garvey was silent. Two weeks ago, the phrase "out in The World" would have done it. It would have summoned to her mind an immediate picture of his own restricted life within severe walls, so sadly contrasted to her own suburban freedom; it would have raked her conscience. And now, in deliberate misconstruction of his meaning, she had laughed! Mr. Garvey wondered grimly whether she was not becoming more adept at his little game. He resolved to try another tack. "You'll stay to supper?"

"No, I'm afraid not, Uncle Martin. I'd love to, of course, but it's such a long drive back, and Arthur is expecting me. We're having some people in tonight."

"It's most likely all for the best," Mr. Garvey said. "The meals we get here are very poor. There's days I don't touch a thing."

"Why Uncle Martin!" She waggled a finger at him and her lips formed a little pout; to his horror, the old man saw that she had determined upon a course of playful reproach. "*Shame* on you, Uncle Martin. And you would never eat when you were with us, either; that's what used to worry us so. You need to eat to keep up your strength. And I'm sure you get plenty of good nourishing food up here: the menus look most attractive."

"On the menu and in the stomach: there's a difference there," Mr. Garvey observed darkly. "A man likes some taste to his food." Actually, he was quite pleased with the institutional cooking, finding it far more to his liking than the gay little neutral meals prepared by his niece. Still, there was the game to get on with, so he said doggedly, "It ain't like home cookin'."

Ellen patted his hand. "Now you're flattering me, Uncle Martin. Thank you very much, but I'm afraid I couldn't begin to feed you the way they do up here. I've never seen you looking better. And naturally your food must be agreeing with you or you wouldn't be looking so wonderfully well, would you?" She smiled briskly and with finality; it was time for a change of subject. "Now," she said, "what nice things have happened to you since I was here last week?"

Mr. Garvey's eyes gleamed; here, unlooked for, was opportunity. "They gave us a television," he said.



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"A television set? Oh, how nice, Uncle Martin! That must be great fun for you!"

"And then," he said triumphantly, "they took it away!" By a great stroke of fortune, the television set had broken down the night before, and had to be removed for repairs. Everyone had been delighted; from the beginning the majority of the old gentlemen had viewed with extreme distaste the flickering antics of brash young comedians, saying things they did not understand.

"Gone for good, I s'pose," said Mr. Garvey with a sigh. He went on to tell a moving tale of aged men, huddled in the reading room, watching with disconsolate eyes as the principal vehicle of their enjoyment was trundled from the premises. As the story came to its hopeless conclusion, he watched her carefully from the corner of his eye, searching for the first sign of sympathy.

"Oh, come now, Uncle Martin, I'm sure you're exaggerating," she said, using the voice he particularly disliked: it was the assured voice with which she minimized the complaints of her small son. "They've simply taken it away to have it fixed; they'll have it back in no time. After all, they want you to be happy, don't they?"

"Aha," he said cynically, but his response lacked conviction.

THERE was no doubt of it, he thought, she was getting hard. Wistfully, he recalled the wonderful occasions of her first few visits when, with mounting distress and anxiety, she had listened to his mournful little fictions and had gone away troubled in heart. But now she had built up an unfeeling immunity; his little game had been destroyed. At the thought, despair surged over him; with bitter eyes he watched his niece as she walked to the window.

"Such a green place," she said, her voice trilling a little. "A cool, green place. It's so lovely here, Uncle Martin: think of all the thousands, the *millions* of people in the hot city at this time of year, and then think of yourself, up here!"

He grunted; he could not trust himself to words. It was then that he heard the tapping at the door and looked up to see old Mr. Calderone.

"A thousand pardons, my good Garvey," said Calderone in his deep, stagy voice. "I didn't know you had company. A thousand pardons. I'll return another time."

"No no," Mr. Garvey said hastily. "Come in, Calderone. Come in, come in, man!" The warmth of the reception was without precedent, for usually when the ancient theatrical face of Mr. Calderone thrust itself through the doorway, Mr. Garvey feigned sleep or desperate illness. He considered Calderone a maniac, or worse, a nuisance; today, however, the man might have his uses. With a faint stirring of hope he said, "I want you to meet the niece, Calderone."

"Niece?" Mr. Calderone stepped jauntily into the room with a great elegance of movement. He was a tall man, only slightly bent, with long white hair and fine dark eyes. "Well, Garvey, you old rogue," he said, in fruity tones of reprimand, "why have you kept this charming creature from us until now, eh? She's charming, utterly charming!" He stood, negligently posed, smiling appreciatively at Ellen; against the worn backdrop of his features, absurdly youthful teeth gleamed.

"Aren't you nice to say such things, Mr. Calderone," Ellen said, with some awkwardness. She was not a little embarrassed by this elderly cavalier with his great young teeth.

"Calderone here was on the stage," Mr. Garvey said superfluously. "What was the name, Calderone?"

"Cardew," said Mr. Calderone. "Edwin Cardew. For the purposes of the marquee, you know. It was a name not unknown in its day, although I'll bet a button that it means next to nothing to this charming young lady. The fame of the player is all too fleeting, alas!"

"I don't believe I've actually *seen* you on the stage," Ellen said tactfully, "but of course I've heard your name." She was suddenly touched by this old man, so pathetically fishing for the rare words of recognition. Generously, she lied again. "I've heard you mentioned *many* times," she said.

"So we are remembered, after all," said Mr. Calderone, and smiled his young smile. "Well well, Garvey, fancy that. There are those who recall the brief hour, so long ago. Ah, they were good days, *great* days, and I lived them to the full. I have always had the knack of leading the full life," he said, leaning confidentially toward Ellen, "even now, here in the asylum."

"I think it's wonderful to be able to enjoy life like that. Although," she added, with a quick little laugh, "I'd hardly call this lovely place an *asylum*, would you, Mr. Calderone?"

"It's quite all right, my dear," Mr. Calderone said comfortingly. "You need have no fear: we are quite without illusion up here. We know our unhappy condition full well, eh, Garvey?"

"We do queer things now and again, I guess," said Mr. Garvey in a strange, small voice.

"Uncle Martin!" Ellen said sharply. Turning to Mr. Calderone, she said, "No, but surely you must realize that this isn't an institution in any — well, in any derogatory sense of the word. It's simply a pleasant home . . ."

"Charming!" said Mr. Calderone, with another great smile. "But it is not necessary, my



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dear. We may be poor crazed men up here, but we are not in the least sensitive about, it are we, Garvey?"

"Ah well," said Mr. Garvey, with a little sigh. Glancing at his niece, he had all he could do to keep from chuckling aloud. This was the stuff, he thought joyously: oh, Calderone was just the boy for the job!

"We do no harm," Mr. Calderone was saying. "We harm no living soul. We may be aged and deranged, but we bear ill will toward none, even to those who are unkind. Sometimes," he said dreamily, "as I stroll about the grounds, I go out to the wall, where I can watch the cars of normal men roll along the highway. And as I stand there watching, I can see the people pointing as they go by, and I know that they are saying, 'There is where the old madmen live.' But I bear them no ill will, I assure you. Instead, I laugh." In demonstration of this, he laughed, loudly and rather alarmingly.

"But you're very wrong!" Ellen cried, looking anxiously at her uncle. "No one says things like that, or if they do they're greatly mistaken. No one thinks that this is a place for the mentally ill, Mr. Calderone. It's simply a *retreat*, where elderly people can live more comfortably . . ."

Mr. Calderone smiled with great benignity. "She's kind, Garvey," he said. "You have a kind girl there. It warms the cockles of the heart."

"She's a grand girl," Mr. Garvey agreed, in his new weak voice. "A grand, kind girl, all right."

"Not all are so kind to people like ourselves," said Mr. Calderone. "Eh, Garvey? And yet we do not mind. For after all, we know that we have nearly run the race. We know that in a few months, or weeks, or even *days*," he said, his fine dark eyes glowing happily, "we go to meet our Maker."

"Dust to dust," murmured Mr. Garvey helpfully.

"And not a one of us can escape, mad or sane," Mr. Calderone said, nodding sagely. "*That* I find the most consoling thought of all." Clearly, it was a thought which exhilarated as well as consoled, for one old hand tossed outward and upward in the gesture of the toast. "All dumped into the dark pit together," he said exultantly. "Eh, Garvey? Day by day we crumble."

"That's so, that's so," Mr. Garvey sighed. "We ain't what we used to be, and that's a fact." He felt like singing: his niece had sprung up from her chair and now stood by the window in rigid disapproval, her back toward them. She was pulling nervously at her gloves; with satisfaction, Mr. Garvey saw that she was on the ropes at last. He thanked the miracle that had brought Calderone to the room. Now, however, the job was done, and he was weary of this tiresome man with all his silly jabber; he said without courtesy, "Well, good-by, Calderone. Run along now."

"Yes, I must go. I have many things to attend to before the day is out," Mr. Calderone said pleasantly; in his daily rounds he had become accustomed to curt dismissal. "Good-by, Garvey, until tomorrow. And good-by to you, my dear," he said with a courtly bow. "This has been a great pleasure. I only hope we may see you again soon although, at our time of life, we make no plans, eh, Garvey?"

"Yes yes," Mr. Garvey said impatiently. "Run along now, Calderone."

Still with her back to the room, Ellen bobbed her head stiffly; Mr. Garvey waved his hand irritably; and with a final elegant flourish, Mr. Calderone was gone.

"Ah, there goes a smart one," said Mr. Garvey in obvious admiration. "They don't fool Calderone. He's the man can tell you things."

"Uncle Martin," said his niece, turning to face him. She stood with her feet wide apart: it was the posture of Resolution, of No Nonsense. On her face, however, was hesitancy and doubt. It was the old familiar mixture that rose to the surface whenever she decided to Do Something about her uncle. Do something, yes, but what?

"Uncle Martin," she said again, and he waved a feeble hand at her and gave her a strangely sweet smile.

"Ah well," he said, his voice barely audible now, "what's to be will be, I guess. You're a grand girl, yes you are."

"Uncle Martin," she said a third time, but more urgently now; and leaning forward, she began to talk to him. Mr. Garvey closed his eyes; his whole being was flooded with a great warm inner smile. He knew all that his niece would say, and exactly the tones in which she would say it. He knew, for example, that the mildly hectoring tone with which she now addressed him was just a bluff. It would not last; as it went on and met no response (other than, of course, the nice little weak smile he would preserve on his lips) it would melt into the familiar wheedling manner, and when *this* got nothing (as indeed it would, for he would even keep his eyes closed tight all the while she talked, and maybe breathe a bit on the fast side, just to help things along) then there would come, at last, the welcome rush of concern and alarm. And that, thought Mr. Garvey with satisfaction, *that* was the stuff for a selfish girl who packs her uncle off to an old folks' home way up in the hills somewheres, and then once in a blue moon trots herself in to see him with her perky little step and her hard little pebble eyes and the ha ha ha on her lips and not a single blessed bit of



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worry in her voice! Oh yes yes, thought Mr. Garvey jubilantly, this was the stuff for her! It was indeed!

It was some time before his niece finally left the room.

"Good-by, Uncle Martin," she said loudly; in reply, she heard only small, gasping snores. She turned to go; then, at the doorway, paused once more. Mr. Garvey, observing her with some difficulty from under lowered lids, noted that she looked perplexed and worried. Then she hurried from the room, and Mr. Garvey, listening, could hear the quick anxious steps moving away from him. He knew that they were going toward the office of the sister-in-charge.

After a reasonably prudent interval, he sat up, smoothing his coat and straightening his tie. He was a neat man, he liked to keep spick-and-span, and partly because of this, partly because he had no more pressing concern at the moment, he rose, went over to the small washstand, and began to brush his teeth. He took great pride in the fact that he still had many of his own teeth; he brushed them several times each day. As he brushed, he stopped frequently, and smiled slightly into the mirror: he was thinking of the dialogue now taking place between his niece and Sister Thomasina.

He knew that, a few minutes from now, his niece would leave the building, get into her car, and hurry off down the gravel drive: she would leave, he thought, faster than she had come. He knew too that later, in an hour or so, maybe, Sister Thomasina would come round to see him. She would ask questions, gently, cleverly; he would be polite, full of common sense, cheerful, convinced that long and happy years yet remained to him. He would be appreciative of everything; he would speak with fondness and gratitude of the home, of Ellen, of the husband, even. Then Sister Thomasina would go away.

After that, there would be nothing to do until supper. Then he would eat, and stop to chat a bit, maybe, with some of the other old men, and then he would come back to his room, listen a while to his radio, and then he would wash, say his prayers, and get into bed, and the day would be over for Mr. Garvey.

And then, next week, Ellen would come again. . . .

## SONG FOR A VIGIL

BY RUTH WHITMAN

The bells all suddenly are nine
Be light my leaf the dark is bold

Love hung all night on a sagging vine
His grape a burr, his leaf a spine,
But now the clocks are ringing nine

Love shook all night in heavy cold,
His song a cry, his kisses old,
Be light my leaf the dark is bold

He comes with feet as bare as mine
And helps me stamp the bitter wine,
For all the clocks are ringing nine.

Be light my leaf the dark is bold.



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*A New Hampshire resident,*
NEWTON F. TOLMAN *is a tree farmer and licensed guide who spends most of his time training grouse dogs while waiting for trees to grow.*

# THE BIGGEST LIARS OF ALL

by NEWTON F. TOLMAN

YEARS ago we used to run into old Tom Blodgett every bird season. On warm sunny days he would be sitting with his back against the stone wall at the south corner of the Blueberry Hill cover. He would sit there all day, waiting for "pa'tridges" to come out and feed. When they got within a few yards he would blast them on the ground with his rusty single-barreled ten-gauge.

Old Tom was the soul of honesty in most things; but he always told us, "The shots I like best are high and pretty near overhead, crossing. I set here and wait for 'em to break out o' them tall pines, and when they git just over the road, I knock 'em."

At their best the trite little exaggerations of fishermen, deerstalkers, and the like cannot stand up against the polished technique of bird hunters. All bird hunters are trained liars. Oh, we might except a few who shoot only pheasant; the pheasant is a first cousin of the Rhode Island Red, so there is no need for lying. The real experts are the upland grouse shooters, the ones who use dogs alleged by their owners to hold points on the elusive grouse. These are the true artists.

They always give the dogs the benefit of the doubt and lie accordingly. They will tell you the dog was pointing beautifully when he only stopped to lift his leg. They will tell you a bird flushed wild when they know well the dog ran smack into it. And they will tell you the dog that ran off after a rabbit just couldn't hear the whistle because of the wind.

New Hampshire Fish & Game figures show that grouse killed in a two-month season, divided among the licensed hunters, would average three quarters of a bird per hunter. Let's say one fourth of the kill was unreported — giving one bird per hunter. Now for every hunter who killed, for example, six grouse, there must be five who got none. Yet who ever heard a grouse hunter admit to getting no birds in a whole season?

In defense of the upland gunner's fanatical devotion to the untruth, let it be said a truly honest one might well trade his gun for binoculars and take up songbird watching. Find a good cover; then just forget to lie — just once — when someone asks where you've been. Next weekend you'll think they're holding a field trial there. Station wagons bumper to bumper, bushes swarming with setters and pointers, Brittanys and Weimaraners.

Safety is the first lesson the novice must learn. We start drilling him on it when he takes his first tottering steps into the cover. He is taken to no choice spots until his lies are natural and convincing. He must watch his footwork when referring to specific terrain, such as mountains, lakes, and streams. A gunner is safe only when, asked of an evening if he remembers the village where we stopped that day to buy some shells, he will at once name a place at least fifteen miles removed.

Our upland grouse is the hardest bird in the world to hit. Rarely does a foolish one sit on a limb waiting to be nipped off. It follows that



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many a gunner, because he is a novice, or too slow on his swing, or just unlucky at finding birds, ends the season with a borrowed feather in his hatband. These unfortunates always say, "Well, I didn't get quite as many birds as usual, but of course it was a poor year anyway." (We always agree solemnly about the poor year even if our logbook tallies up to an all-time high.)

Sportsmen often claim our bird shooting has nothing in common with the British version. They overlook two main points — the same type of gun is used, and the same type of imagination.

A friend of ours casually mentions "that day a few years back when old Spot was in his prime and I killed five grouse over him," and we politely say we remember it well. We do remember well that he killed three.

His British counterpart will mention the day when, on Lord Somersby's grouse preserve, he killed five hundred. And we can assume he did kill three hundred.

If an English sportsman relates in the letters section of *The Field* the circumstances of how, in 1949, he accounted for three grouse on the wing with one shot, the next issue will have a letter topping it. Major T. S. R. Throke-Chillingham, Ret., will write that in August of 1927, shooting from butts near Inverness, Scotland, he brought down four grouse with one barrel of his twelve-gauge — adding that it was raining, temperature forty-six with a thirty-mile wind, time 11:30 A.M. This will bring still another letter, from an old gentleman in Ireland; in 1902, near Killarney, he walked up to a covey of grouse, and getting off but one shot, picked up no less than five dead birds.

After that the editor will presumably have decided to knock it off before they get back into the nineteenth century. Some blighter may even have written him earlier on, displaying the bad taste to doubt the five-bird story.

Our New England birds never fly bunched up in great numbers; even our most skillful liars would hardly attempt a claim of dropping several with one shot. However, a neighbor told us the other day he fired at seven partridge by the roadside and bagged the lot of them. They were ringed round an apple, feeding on it, and his shot got them all in the head. It makes him admittedly six times more guilty than the unsporting gunner who stoops to shoot one bird on the ground. My own method of handling such a shot puts great emphasis on getting the bird quickly under my coat, sprinting back to the car, and getting under way in a flash.

The veracity of our friend the Doctor is legendary in medical circles. Outside his career, the love of his life is a lumbering, fat old pointer named Mercury. The Doctor is a delightful field companion and fine shot. But he couldn't hunt the simplest cover without a guide; not if you gave him a relief map showing every thorn apple and hardhack bush. Still he undertook the entire training of Mercury by himself.

Once we got softhearted and let the Doctor bring Mercury along on an all-day hunt. Pointers are noted for staunchness and Mercury is no exception; he is the staunchest ally of the Audubon Society. On his first cast he expertly chases all birds out of cover well ahead of the guns. Then he relaxes an hour or two, deaf to whistle, frolicking in hardwoods, hayfields, and highways.

While not bird-hungry, we do like to shoot at one now and then. The Doctor was firmly discouraged from ever bringing Mercury with us again, on the pretext that our own dogs needed work. This seemed to have an extraordinary effect on Mercury's behavior. Now every time the Doctor hunts with us we get another bulletin.

Mercury held a whole covey of grouse for half an hour. He pointed a bird sixty feet high in a spruce top. And the latest, "You know, Mercury gets smarter every year. I put him down the other day in that Haunted House cover — not the pines, just the open part — well, Mercury didn't find anything, so he waited till I got out on the road. Then he ran into the pines, crept around a partridge, and put it straight out over my head. And of course, ordinarily, Mercury *never* flushes!"

Shooting is a tense business. Many a hot altercation, if not bloodshed, is averted by a little dissembling in the field. A gunner snaps a quick one at a bird swerving behind a clump of trees. He cries happily, "I hit it! It's down, just beyond these pines."

Meantime from where we stand we can see the bird sail on, unruffled by a single pellet, over the hills and into the next county. But do we say so? Oh, no. We call back, "Good work! Keep a line on the spot — we'll get the dog in."

All hands converge and we start searching every likely thicket. After a decent interval one of us says to the weakening gunner, "You know, I'm quite sure a bird came out, flying strong, after you shot — do you think it was your bird, just possibly?" And pretty soon he decides it *might* have been, though he was right on it, and we may as well go along.

Some breeders advertise "perfectly trained grouse dogs — keen hunters, staunch on point, reliable



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retrievers" from a modest two hundred dollars up. These ads are put out by honest, reputable people, but they use a sort of code the experienced buyer knows how to decipher.

*Keen hunter* means a dog not only keen about grouse, but anything that crosses his path, from field mice to deer. The keen part means once he has started hunting, it takes from one to three days to catch him.

*Staunch on point* means that if, when he gets the scent, you attach a stout rope to his collar and tie him firmly to a tree, he will stay there until you flush the bird.

A *reliable retriever* will come in quickly when you shoot, pick up your bird, and if you reach him in time, will not eat it. While prying his jaws apart you should wear thick leather gloves.

The all-round thoroughly trained grouse dog for our style of shooting is about as rare as the whooping crane. The lucky owner of such a dog will tell you that all the money in New England wouldn't tempt him to sell. This is nearer the truth than anything else you're likely to hear from a grouse hunter.

Long exposure to their human environment has produced in grouse dogs themselves an inherent capacity for lying. They can't talk, some owners to the contrary, but they manage very well in their own way. I will give but one of many examples. It concerns an extremely sly, crafty, clever tan-and-white setter bitch named Sue.

Through a friend of a friend, we were shooting one day with an unknown quantity whose name, we'll say gracefully, was Smith. He turned out to be a game-hog — and worse, one of those who talk of grouse dogs as "broken" rather than trained. "Never make a pet out of a hunting dog" and all that.

Our Sue was unaccustomed to being yelled at, and she didn't like it. She would flash into a cover with an air that said, "Just leave me alone, and I'll get you more shots than any other dog in the business," and the results usually proved she was right. Smith not only yelled at her. He shot a bird and picked it up before she could come in to look for it, thus cheating her out of life's proudest moment.

When he shot another bird, Sue got ahead of him. It was obviously dead and had dropped into a patch of thick brush. Sue dashed in out of sight for a minute and reappeared with no bird. We commanded her to hunt dead, and she went back in and sniffed over every inch of ground, but still no bird. Finally we all hunted for half an hour, but we never found it.

Later in the day the same thing happened again. We tried to apologize for Sue's duplicity, but this time Smith got pretty mad. "That so-and-so dog of yours has buried my bird again — why, if I owned a dog like that, I'd shoot her!"

To our great relief, and Sue's, Smith never asked to hunt with us again. And Sue never buried another bird in her life.

Literal-minded folk — the kind who, finding themselves with only a seventy-five-cent sherry, would never think of decanting it into an old Pedro Domecq bottle — may try grouse shooting, but they never get far. Give them just one day like the one my wife and I ended last season with —

We started off at daybreak with a car full of dogs, lunch boxes, and heavy coats and blankets, hoping it would warm up while we drove thirty miles to The Goat-man's Cover, one of our best. (Not its real name, of course.) Instead it got colder, about fifteen above. The sun went under for keeps, and when we started hunting, our eyes blurred with tears in the stinging wind.

I was crunching along down a snow-covered sidehill, trying to thaw my arthritic fingers inside my coat. My wife was working a young dog over in the cover somewhere to my left. After a while I heard her twenty-gauge, so muffled by the wind it sounded like a cork coming out of a bottle. A second later a grouse crossed ahead of me at about three hundred miles an hour. I got off both barrels well behind it.

"Did you get it?" she called. "Do you want the dog?"

"Heck, no. Keep on going, before we freeze to death."

"Well, why couldn't you hit it? I put it right out to you, didn't I? Apache needs to have a bird shot over him."

"All I could see was a gray streak," I said. "If you're so anxious to get Apache a bird, why didn't you hit it yourself?"

We found nothing more until midafternoon. Then, as we were circling back to the car to warm up, our old dog held five points in succession on grouse in open cover. We managed between us to miss all five. After that fiasco we were both too cold, disgusted, and disgruntled to hunt any longer, and we called it a day.

Some weeks later my wife was talking to a friend: ". . . and you should have been with us that last day. It was just heavenly! The air had that wonderful late-season tang, and the dogs all worked beautifully. We never had better shooting."

"How many birds did you get?"

"Oh, maybe not more than two or three, actually, but it was all such fun — the kind of day you live for, you know."

And the funny thing is, as I look back now, it *was* a wonderful day.



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# THE ENCHANTMENT OF RISK

*"Because it is the most demanding of all games, motor racing is spiritually the most rewarding, too." That is the point of view which keeps the great drivers on the Grand Prix circuits despite lethal accidents, on occasion, to the spectators and the drivers alike.* KEN W. PURDY *is among the foremost commentators on sports and racing cars, and his book,* KINGS OF THE ROAD, *has become a standard work in its field.*

**by KEN W. PURDY**

AT 3:45 on Sunday morning, May 24, 1903, the first of 275 automobiles left Versailles to begin the great Paris-Madrid race. They were to run through Chartres, Tours, Angoulême, to Bordeaux; then to Bayonne, Vitoria, Burgos, Valladolid, and Madrid, where great preparations had been made to receive them. France and all Europe were full of enthusiasm for *l'automobile*, and the great city-to-city road races had conveyed the fever of high-speed motoring to millions. Races had been run from Paris to Marseilles, Marseilles-Nice, Bordeaux-Biarritz, Paris-Nice, Paris-Roubaix, Nice-Salon-Nice, Paris-Vienna, and Paris-Amsterdam, but Paris-Madrid was to be best of all.

Only scholars and devotees remember now the names of most of the starting cars: Mors, De Dietrich, Turcat-Mery, Gobron-Brillie, Serpollet, Passy-Thellier, Motobloc, Richard-Brasier. Of names we know today, only Renault and Mercedes were represented. But all automobiles were wonderful in 1903, and 100,000 wildly excited Parisians jammed the roads to Versailles all during the Saturday night before the race, on foot, bicycle, carriage, automobile, candle-lighted Chinese lanterns bobbing over their heads, and they crowded close to touch the cars as they passed. The cars nosed their way through the mobs, foot-long orange flames slashing from their open exhausts, chain drives clattering, drivers sitting head-high to the crowds, mechanics crouched low beside them.

The English sportsman Charles Jarrott was first off the mark, in a 45-horsepower De Dietrich. The huge, bearded Chevalier René de Knyff, driving a Panhard, was second, and then Louis Renault in a car of his own make. From then on, minute by minute, big cars, small cars, and finally motorcycles were sent away, the last man getting off just as Louis Renault reached Tours, 135 miles from Versailles.

It would be hard to find drivers today who would undertake to push replicas of the Paris-Madrid cars to the limit over 750 miles of badly surfaced road, dust-laden and indifferently marked. Lightness and more lightness had been the universal motto, and the chassis of many of them were dangerously weak: their builders had used the lightest and thinnest material possible and then removed metal by drilling. Chassis frames, even pistons, were drilled out, and brake pedals and gear levers were steel lace.

Light as they were, many of the cars carried big and powerful engines: a Mercedes covered the first 17½ miles in 17 minutes, and Louis Renault's little car was timed, over a straight stretch, at 90 miles an hour. The hazards of the road, high speed and the flimsiness of the automobiles aside, were frightful: there were an estimated 3 million people lining the course, and the force of gendarmery and army men assigned to protect them was hopelessly inadequate; the dust churned into the air by the passing wheels hung so heavily there that following drivers literally steered by setting course on the tops of the telegraph poles bordering the road.

Accidents began almost at once. Marcel Renault, Louis' brother, lost control of his car at Couhé-Vérac, was crushed under it and killed. The Englishman Barrow hit a tree head on at 80 miles an hour. Another Englishman, Leslie Porter, driving a Wolseley, overshot a curve and went straight into the wall of a house. Tourand,



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attempting to avoid a child on the road, killed the child, his mechanic, and a soldier. Louis Renault was the first man into Bordeaux, having been on the road for five hours and a half. Every driver, as he pulled into the control, had a new horror to relate. No accurate total of dead and injured was ever compiled, but it was known that at least twenty people were killed, and the French government stopped the race at Bordeaux. The Spanish government withdrew its permission, too. The cars that had arrived at Bordeaux were not allowed to move again under their own power: they were towed by horse team to the railroad station and shipped to Paris. In the public press, a hue and cry arose at once, and demands for the abolition of automobile racing echoed in political halls.

Over fifty years later, on the twelfth of May, 1957, 301 automobiles began to stream out of Brescia, Italy, in the black early morning hours, to run down one coast of Italy to Rome and up the other to Brescia again in the famous Mille Miglia sports-car race. Uncounted millions of people lined the roads — roads that were, like the Paris-Madrid routes, supposed to be closed off for the day. Still the drivers knew, just as the pioneers had known five decades before, that they would enter and leave every town by driving into a solid wedge of humanity, the narrow end of which would suddenly, miraculously, open an instant before disaster.

Because the Mille Miglia was known to be a dangerous race, with heavy spectator and driver fatalities often marring its thirty-year history, the number of entries for 1957 had been reduced and extra precautions for spectator control had been made. Threats of prohibition had been increasingly common in late years, and those to whom the race meant most were anxious to preserve it: the organizers — the chief spirit of whom had said he would run it, if need be, despite any effort of the Italian government to stop him! — the manufacturers, the sports fans of Italy, where racing is a national sport. For the Mille Miglia was the last of the great city-to-city road races. All the races that had fanned out of the hub of Paris were long dead, nothing left to tell of them but the memoirs of old men, a few faded posters, some ancient silver cups. The Gordon Bennett races, the Ardennes races, the Vanderbilt Cup in America, all had been abandoned. Great Britain had never allowed open-road racing. The modern Carrera Panamericana, run the length of Mexico, had proven too costly in money and blood. There were two sizable road races still extant in Sicily, the Targa Florio and the Giro di Sicilia, but classic though they were, they were not the real thing: city-to-city, the cars never running twice over the same piece of road. This is what automobiles were made to do, and this is the only pure form of automobile racing.

Of all the racing community, only the contract drivers for the great houses, the professionals who spend the six months from April to September driving the fastest cars that can be built, had been able to consider the possibility of the Mille Miglia's prohibition with equanimity. Most of them had come to dislike the race intensely. The present champion of the world, Juan Manuel Fangio, incomparably the greatest driver alive today and sometimes compared with the immortal Tazio Nuvolari, had run five times Brescia-Rome-Brescia and then announced he would never do it again. Don Alfonso Cabeza de Vaca y Leighton, twelfth Marquis de Portago, one of the post-war stars, sat with me in a hotel room in Sebring last March and said very earnestly that he hoped he would not have to run in the '57 Mille Miglia. "Unless you're an Italian you can't hope to know the roads," Portago said, "and as Fangio says, if you have a conscience you can't drive fast anyway. There are too many places where a car can go off the road and kill a dozen people."

Stirling Moss, No. 2 driver in the world rankings, and a man not yet accused of fear, said before the 1955 Mille Miglia, which he won, that he considered it the most dangerous race in the world. He ran with a passenger, an iron-nerved journalist named Denis Jenkinson, former world motorcycle sidecar champion, who signaled every bend in the road, reading an 18-foot-long strip of paper rolled up in celluloid! Said Moss after the race, "I should like to say how grateful I am to Denis Jenkinson for making it possible for me to win this race. . . . Through the whole 1000 miles I took his instructions, and when he said the brow of a hill could be taken at over 170 miles per hour, although I didn't like it, I just kept my foot screwed to the floor and hoped he hadn't made a mistake." Moss averaged 97.9 miles an hour for the 10 hours and 17 minutes he was on the road, still the record.

That then is the Mille Miglia, 1000 miles of ordinary Italian two-lane roadway for most of its length, carrying about 2980 curves, bends, blind hills, and other hazards, a circuit impossible to memorize — and a driver feels secure only on a circuit he has memorized, since no one can safely take a corner at 140 miles an hour unless he knows which way the road bends beyond it. The Mille Miglia is a race for sports cars, not racing cars, but in recent years the distinction between the two has narrowed almost to the vanishing point; the great racing manufacturers, Ferrari, Maserati,



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Mercedes-Benz, Jaguar, produce "sports" cars that differ from full Grand Prix racing machines only in having room for a passenger and in mounting such amenities as headlights, a starter, a spare tire, perhaps a rudimentary top. The Italian machines are particularly ferocious; some of them are capable of 200 miles an hour, and their engines are so highly tuned that they cannot be run slowly through more than a few blocks of traffic without stalling or overheating. Viewed against the accepted definition of a sports car, a machine suitable for both competition and ordinary down to the drugstore errand-running, they are freaks — but they win races.

THE great hazards of the Mille Miglia are four: the ubiquitous, suicidal crowds; the presence in the race of every kind of car in the world, fast and slow, big and little; the tremendous speed of the big cars; and the winding road itself. More often than not, the race is run in pouring rain, but this year it was dry when the first of the small cars rolled down the starting ramp at Brescia. All night long, until Stirling Moss's 185-miles-per-hour Maserati jumped down the ramp and howled terrifyingly through the narrow lane of spectators at 5:37 A.M., the cars left at one-minute intervals, the slower ones first. Moss, favored to win, had reached 170 miles an hour before he was three miles from the start, but within eight miles more he was out of the race: entering a curve at 130 miles an hour, he braked and felt the brake pedal snap off under his foot. Somehow, incredibly — tests have shown Moss's reaction-times to be three times faster than normal — he was able to get into a lower gear and get through the curve, lined with spectators, without losing control. He stopped the car safely.

The twenty-fourth Mille Miglia went on without serious incident until a Dutch driver went off the road and was killed. A motorcycle policeman patrolling another part of the course lost control of his vehicle and was killed. The race turned into a private contest between the Ferrari drivers, Collins, Taruffi, Von Trips, Gendebien, Portago. Collins' car broke down, Taruffi was leading Von Trips and Gendebien, Portago was fourth, when he burst a tire at 150 miles an hour near Guidizzolo, 30 miles from the finish. The big red car swerved, screaming, across the road, left the ground, snapped off a telephone pole, slashed through a knot of men, women, and children, came to rest finally in the roadside ditch. The Marquis de Portago, his passenger Edmund Nelson, and ten spectators were dead.

Editorial denunciation of the sport began within hours, and it was bitter and prolonged. Inevitably the critics recalled the horrifying disaster at Le Mans, France, during the running of the 1955 24 Hours Race, when the French driver Pierre Levegh's Mercedes-Benz left the course at 140 miles an hour and killed more than eighty spectators. The veteran Italian professional who had won the 1957 Mille Miglia after fourteen previous attempts, Piero Taruffi, announced that he would retire in deference to the wishes of his wife, and in a letter to me said that he doubted that cars would ever again run down the long straight roads of the Adriatic coast and over the mountains back to Brescia. Some American newspapers found room on page one for long stories, full of bathos and penny-a-line Freudian theory, explaining the "death wish" that had brought the young Marquis de Portago to an early end; and Mike Wallace, persuading the able American driver and theoretician John Fitch to appear on his television program, attempted, although with little success, to treat him as a prisoner in the dock. Otherwise levelheaded citizens argued that automobile racing should be forbidden, root and branch.

It may be that the great city-to-city races have finished a life of more than fifty years — although I doubt it — but automobile racing itself is indestructible and all talk of abolishing it is nonsense. As long as man has run wheeled things over the earth, he has raced. Individual forms of racing may die out, as the great board-track ovals of the 1920s died out, but man's determination to propel himself faster than his fellow cannot be outlawed.

During the past few years automobile racing *aficionados* have made much of limited participation in the sport by the great Detroit firms. In the great days before World War I every major manufacturer supported racing as a matter of course and as a sure route to publicity. When Detroit switched targets from the male consumer to the female, racing had of necessity to give way to color, upholstery, shape, and the rest of the factors that combine into what we know as "styling."

In the mid-1940s the wheel came round again. Chrysler and Lincoln showed interest in the Mexican road race, and did well in it, too. Oldsmobile, Ford, Chevrolet actively supported the big stock-car events, and the master executives of Detroit, while piously denying that a horsepower race was in being, flogged their engineers for another few foot-pounds of torque. The engine of one Big Three model could produce 405 horsepower on the test bench — as much as any contemporary Grand Prix racing car. It was quietly made known to the racing community that Chevrolet's sports model, the Corvette, would make a



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sustained major effort in international racing. Americans who hoped for an end to the absolute domination of foreign-built machines in road racing were set alight with hope, but cooler heads were less optimistic.

Then, on the sixth of June, 1957, the board of directors of the Automobile Manufacturers Association recommended an end to all participation in racing by member companies. Indeed, the Association went further and recommended that no company encourage or assist any form of competition, or publicize any such event, or advertise the speed, engine size, horsepower, or acceleration performance of its cars. The unannounced reason for this Draconian edict was simple: in about a dozen state legislatures bills were pending which were restrictive of horsepower, engine size, top speed, and so on. Detroit, an admirably well-informed and unified business community, was simply taking the wind out of the legislators' sails. Except insofar as the promising Corvette racing model was concerned, the move was of little importance to racing as a whole.

Certainly automobile racing is dangerous, and the list of drivers who have died at the wheel is a depressingly lengthy one. It is probably the most dangerous of all spectator sports when improper safety measures are taken and particularly when the audience is unsophisticated. When U.S. road racing was reborn after World War II at Watkins Glen, New York, spectators, often with small children beside them, stood literally within arm's reach of the speeding machines. They were in hideous danger and seemed unaware of it. At the present time there is almost no open-road racing left in this country. Spectators watching the comparatively dull track racing have always been reasonably safe, of course, and the current tendency in road racing is to use artificial road courses built on private property. On the private course, spectators can be rigidly controlled. Control is necessary, because automobile racing is perhaps the most exciting sport in the world, and it is a commonplace observation that spectators will always try to get almost close enough to the cars to touch them.

Most professional drivers actively dislike the spectators. Barney Oldfield, first of the famous American drivers, thought them little better than ghouls, and Portago once told me that if he were faced with the choice of hitting a tree or a spectator he would unhesitatingly hit the spectator. In the driver's view, the spectator is a necessary evil at best: he provides the money. A top-ranking driver can make $150,000 a year, but I think that most of the good drivers would run for the fun of it with almost equal zest. Many of them are in a real sense addicted and could not stop driving under any circumstances.

I once asked a well-known driver if he did not think it was true that, of all sports, only mountain-climbing, bullfighting, and automobile racing really tried a man, and that the rest were recreations. He agreed completely. "This is not a game that is essentially a game for boys, like baseball," he said. "This is a game in which you must put up a bond for your life every time you go out to play. Because it is the most demanding of all games, it is spiritually the most rewarding, too."

I have heard many drivers paraphrase that remark. Typically the athlete is dour, uncommunicative, but many of the younger European drivers are sensitive and articulate men. Stirling Moss, Wolfgang Von Trips, Harry Schell, Olivier Gendebien, the late Alfonso de Portago — all have demonstrated a peculiarly acute awareness of life, an overt determination to take the maximum out of it, whether in excitement, taste, love, music, or whatever. All of them concede that mastery of a racing automobile on a road course, particularly on a twisting road course or one in the mountains, offers one of life's monumentally sensuous experiences. It is an experience hard to describe. The unleashed bellowing of an engine which will move the car from a standing start to 60 miles an hour in three seconds, to 100 in eight seconds; the rasp of the brakes, bigger than the wheels and producing, in the course of a 350-mile race, enough heat to warm an eight-room house through a hard winter; the constant controlled sliding of the automobile — all these sensations bear in on one while, a foot away on either side, similar cars driven by other men scream and scrabble for a footing on the roadway.

As in the killing of a bull, or a *rappell* down a sheer face, Grand Prix automobile racing may infrequently allow one error in judgment to go unpunished — but two, never. It is a sport, an anonymous Englishman has said, at which one gets better and better until one gets killed — an exaggeration, but not a big one. The argument will probably never be settled, but I, at least, do not believe that people watch automobile racing in the hope of seeing men killed. I think that most of the 25 million who will watch auto racing in this country in 1958 — only 16.5 million will see baseball games — will be drawn because racing best defines and demonstrates the universal maxim: Only those who are willing to give up life know what it is worth.



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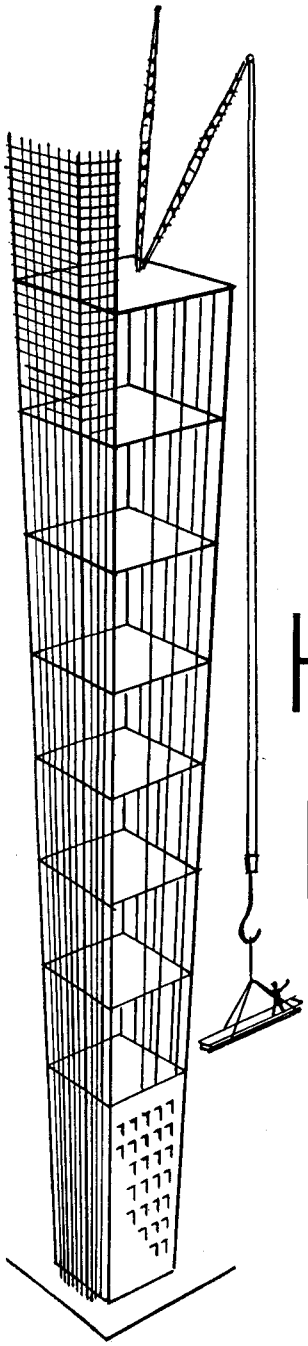

# NEW YORK HURLY-BURLY

BY

PIERRE DANINOS

*One of France's foremost humorists,* PIERRE DANINOS *is the author of a new book,* THE SECRET OF MAJOR THOMPSON, *which Knopf is publishing this month.*

THE day after my arrival in New York, I woke up to find a man in red looking at me jeeringly. It's quite unnerving to come to New York expecting to wake up to a view of Rockefeller Center and to find planted in front of you, instead, a man in red wearing a baseball cap and motorist's gloves!

I sat up with a jerk, and opening my eyes wider I realized that the man was not exactly at the foot of my bed, but a few yards away; he was looking at me through the window from the top of a skyscraper that was going up next door. I knew that there would be no hope of peace and quiet in this room, so I decided to ask the management for another.

On the north side the situation was much calmer — the first day, at any rate. But at the crack of dawn on the second I was awakened by a mighty roar of trucks and cranes. They were starting to tear down the obsolete building opposite. It's the law of existence in New York: everything is either going up or coming down — houses, jobs, gadgets, celebrities, topics of conversation.

I still cannot decide which is the more ghastly of the two noises, but I think the roar of demolition is even worse than the racket of construction. The former begins with the hammering of pneumatic drills digging into the ground and piercing the walls. Then immense cranes carry off whole floors. In the space of a few seconds I saw a living room, a dining room, and two bathrooms borne away. It is all so well done that you are surprised not to see anyone being carried off at the same time. You even wonder how the building ever held together.

Preferring to hear and see people build rather than destroy, I went back to the wing I had previously occupied. This time I got a room on the twenty-fourth floor, and I figured I had a six-day head start on the enemy (who was rising at the rate of one story every two days). A friendly enemy, to be sure, for over the intervening abyss I had established contact with the little man in red; he is called Benedict Camacho, is thirty-seven years old, has two children, a 1955 Chevrolet, a $10,000 life insurance policy, and makes $110 a week.

Contrary to my stupid calculations, which had failed to take into account the all-American passion for breaking records, Benedict Camacho was yesterday once more on the same level as my table. At three in the afternoon he had overtaken me. Tomorrow I shall see only his feet. I would gladly go up another floor, but mine is the top one. Above me there is only the "roof," reserved for parties, receptions, and evening dancing. Which means that when the workers knock off at five in the afternoon (I don't know how those people get down from such heights, but they vanish in the twinkling of an eye), I have a bare half hour of respite. At five thirty the *party* begins — with jazz, and then with the cha-cha-cha.

At any rate, according to my calculations (good or bad) in eight days it will all be over.

Major Thompson, however, proved less patient than I. He claims that it's always risky associating



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with people before they've properly settled in. Besides, he says he can't sleep comfortably unless he's sure of waking up in the same place the next morning. He, therefore, left the hotel and New York, declaring to the desk as he went, "I shall return, gentlemen, when you are built."

And he moved on to the only city in the United States which is more or less bearable to a subject of Her Majesty — Boston. This impregnable citadel of American Anglomania has managed to beat the British at their own game of numbering houses. Imagine the Major's surprise when he discovered between No. 8 and No. 14 on Beacon Street a dwelling numbered 10½. And as though this weren't enough, he then espied through its large-paned windows solemn, whiskered gentlemen snoozing in deep black-leather armchairs under copies of *The Times* — exactly as though they were in the Cavalry Club on Piccadilly.

One can get used to anything in life — even to the hurly-burly of New York. None of this would have mattered much if it hadn't been for the electricity. Paris is regarded, often mistakenly, as the *Ville Lumière*, but New York is really and truly the *Ville Électricité*. It is, at any rate, the first I have ever really made sparks in. In New York there is electricity everywhere — in the door handles of taxis, in hotel doorknobs, between two sheets of paper, in your hair — in everything.

When my wife Sonia, who arrived several days after me, came up to my room, she found me dressed in my underpants and wearing gloves, to say nothing of a little chain around my neck which linked me to the floor. She immediately realized that something was up. I explained to her that the air of New York was so dry and so saturated with electricity that one had to be properly grounded at all times.

"You are joking?" she said.

To prove to her that I wasn't, I took off my gloves and embraced her. She immediately felt the shock and bade me keep my distance.

I then amused myself — if I can so call it — by making a few sparks, just to convince her. I opened a closet here and closed a door there. I have done many things in my life. Making electricity is, after all, an occupation like any other, if only it weren't so painful. I was continuing my demonstration when the telephone rang. As I had forgotten to put my gloves back on I received the communication in the fingers.

"You get on my nerves!" said Sonia. And she left to go shopping.

Apart from the electricity you find in your hotel room — which varies with the amount of steel used in the framework — I always have the impression in New York of being plugged into a high-tension current. The sensation is aggravated if, as was my case, you have just come from Geneva. All of which makes me wonder if the best way to appreciate the United States is not to begin the trip in Switzerland.

Let me explain. When I arrive in Geneva, I feel an invisible hand slowing down my motor. I could almost swear that the stationmaster of Cornavin had given me a dose of quinine. In New York the dose becomes an injection of electricity. Something here speeds you up. No matter where you go, you go quickly. There is a certain New York rhythm you fall in with immediately, whether you are going to buy pajamas at Saks or to blow up the safe-deposit vaults of the First National City Bank.

Strolling is something that has no meaning in New York. In Paris you stroll down the Rue du Chat-qui-Pêche wondering whether you are going to end up in the Rue de la Huchette or come out on the Quai Saint-Michel. But you don't stroll in a city where you are certain of finding 57th Street between 56th and 58th. Who is tempted to write a poem on graph paper?

Americans in general and New Yorkers in particular are veritable human locomotives that go nonstop from seven in the morning till midnight. As for the American wife, she is a super-locomotive that drags her husband after her at such a great pace that he must be sure to be well hitched if he wants to avoid an accident.

A few hours in New York and you, too, will be incorporated in the railroad schedule and become a part of the network. Consciously or unconsciously you become an express train.

It's the same story with those numerous specialists you have to deal with in the hotels. You just can't stop the first flunky going by and give him your dirty laundry, your shoes, a pair of trousers to be pressed, and a button to be sewed on. I have seldom seen a face as put out as the Irish chambermaid's when Pochet handed her a pair of shoes his first day in New York. You could have sworn she had never touched that kind of merchandise in her life. The valet, a distinguished-looking gentleman, considered the shoes in his turn without touching them, and then said to Pochet in a rather scornful tone, "Call the barber-shop."

For a moment Pochet was left wondering if in the United States shoes are given shampoos. Calling up the barber about a pair of shoes may seem strange to a foreigner. But it seemed stranger still to the valet that this ignorant foreigner, from God knows where, should not know that the express shoeshine boy is stationed at the barber's.



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# DRED SCOTT

# — A CENTURY AFTER

## by FRED RODELL

*"The Dred Scott case of 1857 is the most famous — or notorious — in all of our judicial history," says* FRED RODELL, *professor of law at Yale University. Mr. Rodell's latest book,* NINE MEN, *is a political history of the U.S. Supreme Court.*

A RESPONSIBLE if somewhat sectionally slanted journal was commenting on a controversial decision of the Supreme Court of the United States. "The most sacred and binding compacts of former years," it growled, "were annulled to make way for it; and the judicial department of the government was violently hauled from its sacred retreat, into the political arena, to give a gratuitous *coup-de-grâce* to the old opinions and the apparent sanction of law to the new dogma." And in a later issue: "Whatever the . . . judges of the Supreme Court may seek to maintain, they cannot upset the universal logic of the law, nor extinguish the fundamental principles of our political system."

*Plus ça change, plus c'est la même chose.* This was not a Southern newspaper or magazine protesting the anti-school-segregation decision of 1954. It was New England's own *Atlantic Monthly*, protesting early in 1858 the Dred Scott decision.

The Dred Scott case of 1857 is the most famous — or notorious — in all of our judicial history. It is the only one that every schoolboy knows by name, though rarely by its full name, which was *Dred Scott v. Sandford.* It is the only one that helped bring on a major war. It is one of only three decisions in 168 years of Supreme Court annals that were eventually reversed, not by the Court itself, not even, legally speaking, by war, but by amendment of the Constitution. (The other two were *Chisholm v. Georgia*, a minor insult to state sovereignty reversed by Amendment XI, and the *Pollock* income-tax case of 1895 reversed by Amendment XVI.) And when the anti-segregation ruling of three years ago was called by several commentators "a second Dred Scott case," they did not mean to lump together, ideologically, the Court's greatest anti-Negro and pro-Negro decisions; the metaphor merely put the new case beside the old at the pinnacle of political importance.

Yet, for all the familiarity of its name and of the bare fact that it bestowed judicial blessing on the institution of slavery, the full story of the Dred Scott case is not widely known, even among lawyers. Indeed, the off-stage scenario did not come to light until well into the twentieth century, when the papers of President Buchanan and, later, of Justice McLean were published. Had that story been contemporarily known, the newborn *Atlantic Monthly* might have used still harsher language than it did when it spoke of "a Court whose members are selected, not for uprightness of character or breadth of mind, but by the inverse test of their capacity for cringing subservience to party."



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For, when else has the Supreme Court been chivvied into making a major and explosive political pronunciamento out of a case it could have handled, and originally planned to handle, on a mild and minor ground — chivvied by the declared intent of one Justice, who was openly ambitious for the presidency, to turn his dissent into a stump speech in behalf of his future candidacy? When else has a President-elect (or a President) used his influence to change the vote of a Supreme Court Justice? When else has a President, in his inaugural address, blandly adjured the nation to accept in good part an anticipated Supreme Court decision, "whatever this may be" — as though he were not fully aware of how that decision would go, of how each Justice had voted, and that the ruling would be handed down in exactly two days?

And when else have the echoes of a Supreme Court decision reverberated down the decades and come out, a century later, precisely in reverse? The Negro question, with its oratorical overtones of states' rights against national power, is still very much with us, though on a slightly more civilized level. But today it is the North that lauds the Court, the South that damns. Today it is the South that talks of impeachment and nullification; after Dred Scott — until Lincoln went to the White House — these nostrums were bruited about in the North. If for no other reason than its immediacy as political paradox, that old case which was cooked up in the name of an illiterate Negro slave deserves centennial recollection.

The flavor of the case and of the times is perhaps best recaptured by a verbatim transcription of part of the "agreed statement of facts" which opposing counsel submitted to the Court. The problem of Negro slavery — or, more accurately, of Southern planters against Northern merchants and traders — had been simmering at a slow boil throughout the first half of the century. By the mid-1850s the South was in the saddle in Washington. A hell-for-leather Democratic Congress had passed the Kansas-Nebraska Act, repealing the Missouri Compromise of 1820 and letting Kansas, Nebraska, and any other future states north of the old Compromise line come into the Union as slave states if they chose. Weak Democratic President Pierce, although a New Englander, had halfheartedly supported the act. On the Supreme Court, Chief Justice Taney could count on four Southern colleagues to make a majority, and one of his Northern brethren, Justice Grier, was not unsympathetic toward the South. Into this atmosphere came for decision the Dred Scott case, started in a federal district court in Missouri while the Kansas-Nebraska Act was winging its way through Congress, but dealing with events of twenty years before:

"In the year 1834, the plaintiff was a negro slave belonging to Dr. Emerson, who was a surgeon in the army of the United States. In that year, 1834, said Dr. Emerson took the plaintiff from the State of Missouri to the military post at Rock Island, in the State of Illinois, and held him there as a slave until the month of April or May, 1836. At the time last mentioned, said Dr. Emerson removed the plaintiff . . . to the military post at Fort Snelling, situate on the west bank of the Mississippi River, in the Territory known as Upper Louisiana, acquired by the United States of France, and situate north of the latitude of thirty-six degrees thirty minutes north [this was the Missouri Compromise line] and north of the State of Missouri. Said Dr. Emerson held the plaintiff in slavery at said Fort Snelling, from said last mentioned date until the year 1838.

"In the year 1835, Harriet . . . was the negro slave of Major Taliaferro, who . . . sold and delivered her as a slave at said Fort Snelling unto the said Dr. Emerson hereinbefore named. . . .

"In the year 1836, the plaintiff and said Harriet at said Fort Snelling, with the consent of said Dr. Emerson, who then claimed to be their master and owner, intermarried, and took each other for husband and wife. Eliza and Lizzie . . . are the fruit of that marriage. Eliza is about fourteen years old, and was born on board the steamboat Gipsey, north of the north line of the State of Missouri, and upon the river Mississippi. . . .

"In the year 1838, said Dr. Emerson removed the plaintiff and said Harriet and their said daughter Eliza, from said Fort Snelling to the State of Missouri, where they have ever since resided."

But it took eight years before said plaintiff suddenly started suit in the courts of Missouri to win the status of freeman for himself (and his family) on the ground that, by having once lived in a free state, Illinois, and a free territory, now Minnesota, he had automatically and permanently severed the bonds of slavery. And it took eight more years, after he lost in the Missouri courts, before the federal Dred Scott case got under way.

Meanwhile, "master" Emerson had died and his widow had married an abolitionist congressman from Massachusetts, named Chaffee. Twitted on all sides for his wife's ownership of slaves, Chaffee soon fixed up a technical transfer of the Dred Scott family to his wife's New York brother, John Sandford, who thus became the Dred Scott case defendant. That both Chaffee and Sandford encouraged, if they did not actually assist, Scott's suit — after the aging Negro had been a bit lackadaisical about seeking his own freedom — and



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that Scott was promised that freedom beforehand (and later got it) no matter which way the case should be decided, make clear that this was one of those contrived "test cases" lawyers delight in.

*Dred Scott v. Sandford* reached the high tribunal, on appeal, early in 1856. The Court was then made up, along with Chief Justice Taney from Maryland, of four other Southern Justices — Campbell of Alabama, Catron of Tennessee, Daniel of Virginia, and Wayne of Georgia — and four Justices representing (and the word is accurate) the North — Curtis of Massachusetts, Grier of Pennsylvania, McLean of Ohio, and Nelson of New York. These nine, after they heard the case, decided in conference to dispose of it on a narrow and unexplosive ground. They would simply say that whether Dred Scott, once back in Missouri from his sojourn on free soil, was a slave or a freeman was the business of the Missouri courts, not of the federal courts; case dismissed. Had this plan of procedure been carried out, Northerners Grier and Nelson would have gone along to make the vote seven to two — Nelson was even prepared to write the Court's opinion — and the Dred Scott case would have dropped into oblivion. But at this point personal and partisan politics began to seep, then to flood, into the case, until there was no stopping a judicial deluge on the whole seething subject of Negro slavery.

It was Justice McLean of Ohio who started it. His eye firmly focused on the White House come 1861, or even 1857, he bluntly informed his colleagues that if they went through with their plan of shucking the case off on a matter of minor moment, he would deliver a ringing dissent, not so much against the decision itself as against slavery, blasting the Court for supporting the evil practice by indirection. Then Georgia's Justice Wayne counterthreatened a treatise in reply, which would defend slavery while chiding his colleagues for sliding away from the real issue; and Justice Curtis of Massachusetts got ready to answer Wayne and back McLean with an abolitionist tract of his own. Faced with this forensic free-for-all, the Court voted to put off decision until after extended reargument next term.

Postponement meant that a presidential election would intervene before the Dred Scott finale. And this accidental fact opened the case still wider to political influences and pressures. For Democratic President-elect James Buchanan, though a Pennsylvanian, was more than mildly sympathetic toward the Southern view and angrily impatient with the troublemaking abolitionists. Thus, with Congress safe for slavery, as for some time past, and a new President coming in whose sentiments were at least acceptable to the South, the Southern majority of the Supreme Court were emboldened to put the third branch of the federal government in the same camp — and in a substantial way. The result was the full-blown and inflammatory decision, holding that Negroes, per se, were not U.S. citizens (and so could not sue in U.S. courts) and that the Missouri Compromise (on which Scott had based his claim to freedom after living above the line) had been unconstitutional from the start, since no Congress had power to ban slavery on any Western soil, before or after statehood.

As they prepared to announce to the nation that slavery or no slavery was strictly a state (or territorial) question, constitutionally out of the reach of congressional control, the five Southern Justices were well aware that they were about to spike the biggest gun of the fledgling and fast-growing Republican Party. But the Taney quintet were also aware that if such a ukase should come from a Court split five to four on solidly sectional lines, any dunce would see the nakedly political nature of a supposedly nonpartisan proclamation of law. So in February, 1857, just before Buchanan's inauguration, the behind-the-scenes finagling began.

First, Justice Catron of Tennessee sent off a note to Buchanan, informing him that the Court was ready to hand down its Dred Scott decision, revealing that the ruling would be based on broad grounds involving the constitutionality of the Missouri Compromise (Catron did not have to specify which way the case would go), and urging the President-elect to use his influence with fellow Pennsylvanian Grier toward a strong decision, to "settle the agitation." Buchanan immediately complied. Whereupon Grier wrote back, telling Buchanan "in confidence" precisely how and by whom the case had been decided and assuring him that the decision would not be announced until March 6, two days after the inauguration.

Grier did not actually promise in writing to switch his own vote and so create a more impressive majority. But he made it safe for Buchanan, in his inaugural, to exhort his countrymen, North and South — with an air of innocent impartiality — to accept with good grace whatever decision came down. And when it did come down, the vote was six to two against the Missouri Compromise, with Justice Grier added to the Southern five. (Justice Nelson alone stuck to his guns, refused to consider the Compromise, and filed the brush-off opinion which would have been the Court's had the case been disposed of the term before.)

Except for Nelson's, and for Grier's two brief paragraphs, all the opinions were long political tracts, for or against slavery. Taken together, they filled 234 small-print pages in the Court's official reports. The opinion of the Court was, of course, written by Chief Justice Taney.



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For fervor of feeling, for sectional chauvinism, not even the McLean dissent that had sparked the fireworks could match Taney's pseudo-judicial diatribe. With obvious relish, he castigated the holier-than-thou preachments of the North, "where the labor of the negro race was found to be unsuited to the climate and unprofitable to the master." He spewed special scorn at coastal New England for professing a pious concern for the Negro while its bankers and shipowners prospered from "the slave trade, procuring cargoes on the coast of Africa and transporting them for sale" in the South. On a legal level, not satisfied to label the old Missouri Compromise unconstitutional and let it go at that, he insisted on adding gratuitously that no Negro, slave or free, could be a U.S. citizen, so that Dred Scott had no standing to sue in a federal court. (By proper judicial procedure, this last holding actually made the Missouri Compromise argument gratuitous; if Scott had no right to sue, the case should have been dismissed without further ado, on that ground.)

As soon as news of the decision was announced, the nation was rocked from top to bottom. One of the protestants, though his first reaction was milder than most, was Abraham Lincoln. Quoting Jefferson, he remarked that "our judges are as honest as other men and not more so. They have, with others, the same passions for party, for power, and the privilege of their corps." Lincoln also expressed his belief, as a lawyer, that unpopular Supreme Court decisions could — and should — be reversed by a majority vote of Congress. He could not then know that it would take a civil war to reverse *Dred Scott v. Sandford.*

*Plus ça change, plus c'est la même chose.* Today again, though from the opposite point of the compass, come indignant denunciations of the Supreme Court and its highhanded declarations of law. Today again come plans and proposals — no less than seventy such bills were introduced at the 1956 session of Congress — to clip the Court's wings. Today again, the old cry of "states' rights" is in the air. Today again, it is our Negro compatriots who are the innocent cause of it all.

And yet, it is not the same thing today. The Negro is no longer a piece of property but a human being and a citizen, albeit too often a second-class citizen. The Supreme Court that called for an end to public-school segregation in 1954 did not do so by a sectionally split decision but unanimously, though its membership included Justices Black of Alabama, Reed of Kentucky, and Clark of Texas. No one in his right mind remotely supposes that President Eisenhower had to urge any of these gentlemen, or could have persuaded any, to vote as they did. And for all the fuss and the fury, the decision will result in no civil war. The nation has grown up a little since 1857.

But the nation has not grown up enough to distinguish clearly and consider separately the two basic and basically disparate issues that underlay the post-decision dispute in the last century and that underlie the post-decision dispute today. One is the status of the Negro — especially, though not exclusively, in the South. The other is the political power to be accorded to the nine men appointed for life who happen to make up the Supreme Court of the United States.

On the first issue, by every canon of democracy and humanity, the North was right in 1857 and is now right again. This is not to say there is not still, as Taney charged the last time, an element of hypocrisy in the Northern view — what with segregation in housing, discrimination in jobs, and a wealth of available private schools above the Mason-Dixon line. Nor is it to say that the Southern moderates do not have some sense on their side when they ask a little time to reorganize a sizable chunk of their social order. But in 1957, with the eyes of the nation turned anxiously outward toward a world peopled mainly by men whose skins are not white, it could be suicidal as well as inherently indecent to treat our own Negroes as less than complete equals.

On the second big issue — the power of the Supreme Court — the answer is not so clear. What is clear is only that the issue ought to be considered quite apart from the heated partisanship engendered, in 1857 and in 1954 (and also before and between), by a controversial decision. There is something to be said for the notion that the nine Justices hold, or at least wield, too much arbitrary political power, and it has been said in the past by such solid citizens as Jefferson, Lincoln, both Roosevelts, and Justices Holmes and Stone (in dissent). But to rest such a conclusion or its opposite — leave the Court alone — on the boiled-up emotions of the moment is to invite trouble in the long perspective of time.

This is the least we might learn from the Dred Scott case, looking backward over one hundred years. Southerners of today may chortle at the old *Atlantic Monthly's* anti-Supreme Court strictures, but they will find cold Southern comfort in the paeans of praise that emanated from their own political ancestors. Northerners may smile that the South once waved the banner of Court supremacy, but the words of Lincoln ought to give them pause. Let both sides ponder their present motives in the light of what they would have felt and said — not about the status of Negroes but about the Supreme Court — had they been alive when the nine Justices denied Dred Scott his simple plea a century ago.



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# ZARD

by ARTHUR H. TASKER

*A businessman who turned to writing in the autumn of his life,* ARTHUR H. TASKER *was born in Granite Falls, Minnesota, but now makes his headquarters in the Idaho mountains. "I have always loved words," he writes, "written words, especially those rising out of the heart's experience and contemplation."*

I woke to the sound of music, deep, rich, and penetrating. It filled the whole place — vast music, music from the skies. I was vitally aware of angels; had been, since my younger brother died in the swirling waters of the lower dam. I trembled now, but in some ways I was glad. Then I heard the subdued voices of my two older brothers, who slept in the other bed. They, too, had heard the great sound. They did not think of angels; but — what was it, that pouring song? Jamie, who was four years older than I, was speaking but stopped short: "Sh-h-h."

Benny, who was in between as to age, was not excitable, and never afraid. "What is it, what do you think it is?" he asked drowsily. But Jamie's words roused us to reality: "Geese, *geese*, millions of them."

There was no more sleep for any of us that night, as the huge choir chanted on in its loud chorus. At daybreak we were up and out in the warm late Indian summer air. It was October 14; we knew, for Charlie Dodsworth, our friend, the banker's son, would be sixteen on October 16, this year of 1880, a boy's way of remembering dates.

Daylong and nightlong of the fourteenth and fifteenth, the undiminished flight went on. How *could* there be such vast wedges of Canadian geese and ducks, fairly dimming the skies! Then, on the morning of the sixteenth, there was a stilling of sound. It was almost startling, this sudden quiet. A few scattered wedges of geese went wearily south, too driven and worn to make a sound. The old black hen under the cherry bushes scratched for worms, her chicks just in the change from soft dark down to edging feathers; she had stolen her nest in the late summer, this hen. And now it was indeed late in the season, this balmy October day — later than any of us could have believed.

My father unlocked the door of his hardware store on the west side of the Minnesota River, here in Granite Falls, and busied himself for a time turning paint cans to prevent hardening; I swept the floor and dusted with a damp cloth. There had not been a customer as yet; farmers were wary, something was strange. The door burst open and Matteson thrust in head and shoulders. He was breathless, but managed to say, "Close up, Tasker; hurry home; there's an all hell of a storm coming; run, or you'll never make it!"

This was a shock. Father knew this weather-wise old Norwegian meant what he said, however inelegantly phrased. We ran: two long slanting blocks to the bridge, over it speeding, clickety-click, now south and down the steep road to the creek in the beauty of autumn trees, over that bridge and up the slope past the bleak school-house, on, up, and along the ridge path. He was fleet of foot and as nearly scared as an English-born man could be. I was even more alarmed, for indeed a change had come over things. A misty warm pressure, a closing light, was in the air; and then, out of the north and west it came, a rising roar. The riverside trees began to rock; then, like the physical blow of a mysterious hand,



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a great white mass struck, and sent us staggering — wind that was crushing, snow that closed out the light and sucked the very breath from nostrils or open mouth. Here, within a hundred feet of his home, the place he had left snuggled against this very stone-studded ridge, my father stumbled, loosing my hand as he fell.

When first the storm had struck, setting the timbers of the house quivering, Mother had opened the woodshed door, only to be hurled against the summer-season stove. But she felt no pain or injury — not then. With Jamie's sturdy help she managed to close the door. "Oh, Tom, Tom, where are you?" She was crying, but Jamie comforted her: "Mother, Mother, no! Just think what time it is. They are at the store. Don't cry."

Mother, I fancy, had looked at her first-born in something like surprise. "You're brave," she had tried to say, with a new flood of tears. But what they should have guessed was that the mettlesome father they had in mind was not one to leave his family in fright and anxiety, not if he could help it.

What that family were thinking, halfway saying, was that they must wait and wait — for hours; if need be, for days. "O God, merciful God, help us, save us!" It was, then, a shock that made my mother scream, when the door again burst open and a blinded, staggering ghost came in, leading a smaller ghost by the hand, mid rush, roar, and pelting snow. Our faces were plastered white in snow; so too my father's beard and small mustache; in every line of clothing, snow.

My mother screamed, but then, quick-witted, a woman of action, she seized a towel and began swiftly to humanize this man she had loved since she was sixteen, and then myself — these two whom she and two staring boys had looked upon, moments ago, in awe.

The first words Father said, as soon as he had recovered his breath, were: "God, and no one else, put my fingers on the latch." Mother began to cry, and I, too, cried, and even Benny. Oh, we were home again, we who were so nearly lost. How near indeed.

In what was called the parlor or, more often, the front room, there was a sofa, an uncomfortable couch upholstered in figured Brussels carpeting, our showpiece, much admired. There Mother made my father lie down, and she covered him with a padded quilt, though he protested that he was boiling hot, which from our long run and the warm, humid day was readily true, howling blizzard and wintry storm to the contrary. To me it had been less of a strain. I lived outdoors. I, too, was fleet of foot.

When Mother came from the bedroom's huge curly maple bureau, bearing winter underclothing and towels, we three boys and our young sister, Prudence, were shooed from the place to the kitchen-dining room. What was said there in the front room, what tears shed, what prayers of gratitude, we, the children, were never to know.

Later in the day, on Father's request, Benny came into the kitchen with the two clotheslines, and my father showed us the sailor's knot he had learned in the long voyage from England's lovely shores; that, too, had been flight.

And now the lines were knotted together into a single long line with a draw loop at one end, which would be fastened to the clothesline hook outside the woodshed door. At early chore time, Father and stouthearted Jamie, on Mother's insistence, tied themselves loosely together, father and son; then, milk pails swinging, their hands on the guideline, they forced themselves out into the blinding, moving density of blizzard snow.

It would be hard to imagine what it must have been like out there in the unprotected barn, with its thin, single-boarded roof and walls. Why, even here in the well-built, plastered house, snuggled close to the protecting hill, we were shouting to each other in an effort to be heard, so deafening now had become the thundering impact of the storm. "Long away?" Try to think of all there was to do: the feeding down from the mow of snow-laden hay, forkful after forkful, to the mangers below; the mixing of ground cow feed with salt, and snow for moisture; oats to be measured and fed to the horses; corn shelled for the ravenous clutter of hens and the yellow-legged fryers; corn on the cob to the three fattening hogs, silent for once in the greater sound.

When Jamie had finished telling us all these things they had done, he suddenly paused. "And if you'd climbed with me into the hayloft, you'd have been surprised, for there were five beautiful, scared prairie chickens back in the west end of the hay. Must have flown in at that open place. They kept turning their heads and I thought they were going to fly out again. Poor things!"

Benny asked excitedly if they were likely to be there in the morning. And why couldn't we catch them, putting up sheets or something, to keep them from flying out? Jamie looked at Benny in a puzzled way. "Would *you* do *that* . . . to things caught in a storm, just flying in?"

Prudence, a very sensitive child, turned her large, round, blue eyes on Benny, and slowly they misted over. She loved him. We were silent. A color of red crept into Benny's cheeks. Benny, the gentlest one of us all, was ashamed! And so, too, was I, who had shared his impulse, his thoughts having been my thoughts. I felt a sudden tenderness for all things lost, or — so nearly lost.



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# OF SPACE AND TIME

## BY NANCY CARDOZO

For we have seen wild geese in passage, low
over the needles of gold weathervanes
that spin the wind around; primeval arrow,
harbinger of the north; and heard again
the sound of distance falling as they go.

Lucifer fell from heaven; that was down.
And on the pole of gravity we move,
placing the stars above the steepled town
with names, as if the Pleiades could prove
a difference between then and now.

Memory is a trick to save the mind
from too far wandering. Mind has no place
but recognitions whistling on the wind
of roofs and spires, and a certain grace
of valleys that the great wings leave behind.

So we have seen and shall forever see
wild geese stretched upon an oval sky.
(Sight, created by the will to be,
and flight, the passionate desire to fly.)
The shell of vision holds reality.

Birds, warriors of space, who lightly wear
your ancient armor: in your dance
set free our orisons, and on the air
describe the necessary relevance
that mind can only know and body bear

with the wild gesture that becomes a word.
The weathercocks bow down, the wild geese come
crying. Yet somewhere in the town are heard
school children learning in a simple tongue:
I love, you love, he loves. . . . Eternal bird

singing of time in temples of the ear:
all that we ever know is waiting, while
geese fly over at the fall of the year,
the north star takes the sky; and in a child
speaking our own mortality appears.



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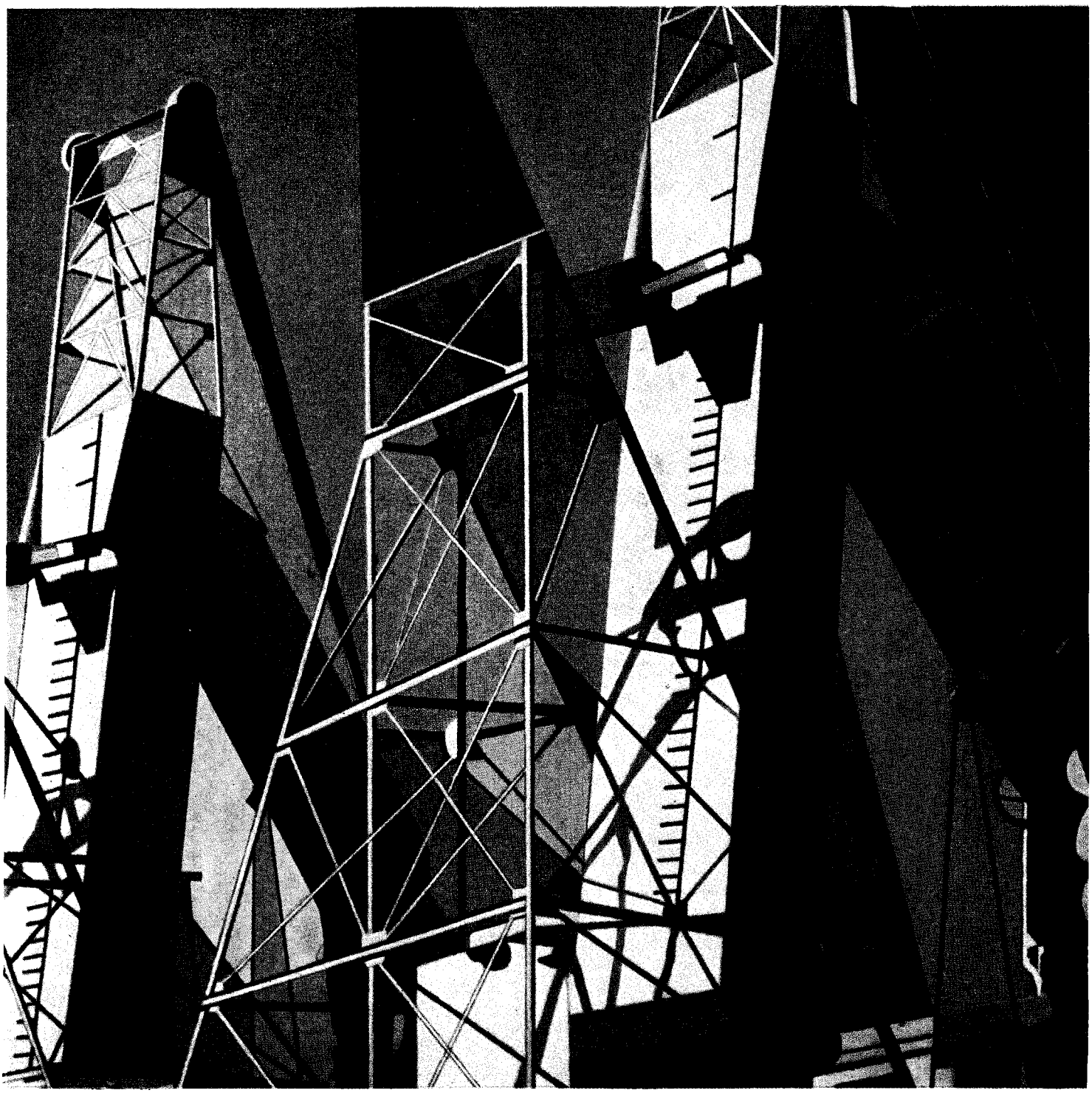
# A FORWARD LOOK AT SCIENCE AND INDUSTRY



*The Web* by Charles Sheeler

*Reproduced by courtesy of Mr. and Mrs. Roy Neuburger*

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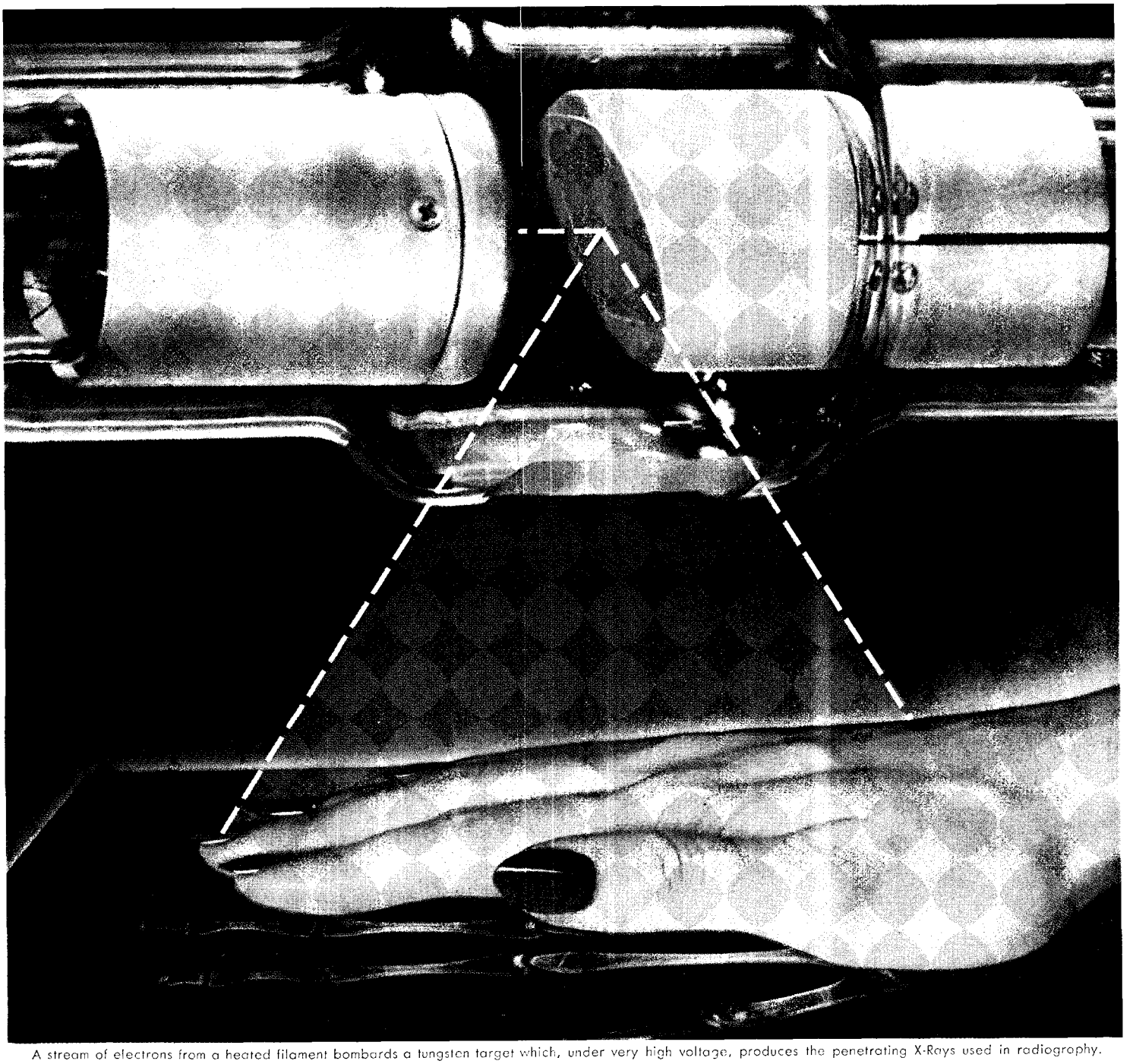

A stream of electrons from a heated filament bombards a tungsten target which, under very high voltage, produces the penetrating X-Rays used in radiography.

# Copper that behaves in a vacuum makes better X-Ray tubes

**THE PROBLEM:** In producing X-Rays, the modern vacuum-type tube also produces heat. Less than 1% of the electric power needed to run the tube becomes useful radiation – more than 99% is turned into unwanted heat. So the tungsten target is usually mounted in a block of copper—the best conductor of heat and electricity among commercial metals.

The need for keeping a high vacuum in the tube also poses a problem. Even solid metals can contain gas, either in solution or in small pockets or voids. For the large copper piece holding the tungsten target, General Electric's X-Ray Department needed a deoxidized copper of high electrical and thermal conductivity that would be free from volatile elements that might contaminate the tube in operation or form gas pockets behind the target, resulting in impaired conductivity from a poor bond between the tungsten and the copper.

**THE SOLUTION:** The American Brass Company suggested a special type of copper. Its metallurgical laboratory had accomplished the difficult feat of deoxidizing copper with boron, thereby producing a special copper having all the qualities necessary to make better, more dependable, longer-lasting X-Ray tubes.

**THE FUTURE:** This is just another example of the way in which Anaconda and its manufacturing companies—The American Brass Company and Anaconda Wire & Cable Company – are working with industry to help solve special metal problems. Contact the *Man from Anaconda* today. The Anaconda Company, 25 Broadway, New York 4, N. Y. 56251 Rev.

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# A FORWARD LOOK AT

# SCIENCE AND INDUSTRY

*AN ATLANTIC SUPPLEMENT*


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# INTRODUCTION BY THE EDITOR

## EDWARD WEEKS

HISTORIANS looking back at us a century from now will marvel at the speed with which scientists transformed the life of Western man. According to Dr. Caryl P. Haskins, president of the Carnegie Institution in Washington, the industrial laboratory did not appear in America in its modern form until 1908, and not until 1928 did its pattern of research become common. But from that moment forward the scientist has come to be preeminent in our armament and agriculture, preeminent in our industry, our medicine, and our universities. In this sudden ascendancy scientists, not always the most articulate of men, have often been out of touch with the rest of us. So absorbed have they been in their projects, so technical is the language in which they work, that a gap has inevitably developed between the laboratory and the world which it has at once enriched and imperiled. It is the purpose of this Supplement to try to bridge that gap.

In 1857, when the *Atlantic* was founded, it was still possible for a scientist to read all of the articles published in his field. But today, as Dr. I. Bernard Cohen conjectures, some thirty thousand scientific articles are published every week. The *Atlantic* editors clearly needed a blueprint which would help them to ask the right questions and to find the right spokesmen, and by disclosing this blueprint to our readers, we hope to make them as interested as we have been in this inquiry.

We felt that the Supplement should begin with the most fundamental questions: Is man still free? Can he in fact choose his course? Or is he a captive to physical laws so exact and compelling that he has no choice? Arthur H. Compton, Nobel Prize winner and physicist, believes that our horizon of freedom is wider today than it was at the time of Newton. Then, since this is the Atomic Age, in what ways can the atom be beneficially employed? Here we selected for our guide a British nuclear physicist, Dr. Otto R. Frisch of the Cavendish Laboratory.

Having plotted our position by these two stars, we paused to size up the ship's company and the passengers. What can scientists tell us about people as they respond to the pressures of our era? What is race? What is its importance in the eyes of an anthropologist like Carleton S. Coon? We used to think of ourselves as an aging nation, but since the end of the Second World War we know this is no longer true. That the enormous acceleration of our birth rate can keep our economy booming is one of the first findings of Frank Notestein of Princeton. Again, what about the new opportunities that women have claimed for themselves in science as more and more they move into our work force?

The harnessing of the atom and the conquest of the air are the two great discoveries of our time. Not until the *Atlantic* was fifty years old did man succeed in spending a few seconds in the air in powered flight. Today the technology of flight has lifted our horizon from the seas and the mountains to the moon and the planets, and tomorrow we reach out to new universes as unknown to us as the Americas were to the Europeans five hundred years ago. When the engineer struggles with Einstein's ideas of time and space, technology becomes almost metaphysical.

It has always been the function of the *Atlantic* to ask questions, and the more probing the better. These articles by the most articulate scientists we could find, these papers by industrialists such as Edward P. Curtis of Eastman Kodak and David A. Shepard of Standard Oil of New Jersey, these predictions by Raymond Stevens of Arthur D. Little, Inc., are all endeavors to show where scientific research will lead. Our concern is not with the century that is past, but with the one that is beckoning.

We wish to thank Dr. Caryl P. Haskins and Dr. Vannevar Bush for their friendly counsel, and Hartley E. Howe for his invaluable assistance in editing this Supplement.



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Dr. Arthur H. Compton, *former chancellor of Washington University, St. Louis, and Nobel Prize winner, shows how we have outgrown the mechanistic determinism of Newtonian science as we enter the freer and more optimistic realm of the atomic age.*

# SCIENCE AND MAN'S FREEDOM

## by ARTHUR H. COMPTON

What is the best in life that we can hope for? What shall we do to attain this best?

The very asking of these questions implies that we can do something to change our lot. Can we by trying affect what happens to us? Is it consistent with the laws of science that man shall have such freedom? On this essential point theologians, philosophers, and scientists have had sharp differences among themselves. Yet here is the very basis of man's responsibility. Responsibility has no meaning except as one is free to set his own course of action. If he is not thus free, both the sense of achievement and the feeling of failure are illusions. Indeed it is only as man is free that his aspirations make any difference, that his life has meaning and worth. If we are to discuss science and human responsibility we must thus ask first of all, does science admit that man is a free and responsible being?

One of the crucial episodes in Greek history was Socrates' decision to accept the verdict of death as given by the people of Athens. Socrates was waiting in prison for the appointed day. A friendly jailer had left the door unlocked. His disciples were urging him to flee. Socrates' reply has had an impact on the thinking of nearly a hundred generations. In effect this is what he said:

> When I was a young man, I studied Anaxagoras' book on physics. He would have me believe that I am sitting in this crouched position on my cot because of the tension of the tendons over my joints. What Anaxagoras doesn't seem to know is that I sit here because I will not break the law of Athens. The people have condemned me to drink the hemlock. As a man of honor I will not creep stealthily away.

It was not the laws of physics that determined that Socrates should remain in prison; it was the code of honor to which he committed himself. Even in death Socrates was free.

In another notable case the conflict between science and faith in the power of will altered the course of history. In the tenth and eleventh centuries in the Arab world, science was growing vigorously, but in the twelfth century this growth suddenly ceased. I am told by Islamic historians that the reason for the sharp decline was the antiscientific attitude of Islamic religious teachers from the twelfth century onward. These teachers, in particular the famous al-Ghazali, feared the study of science because it tended toward disbelief in God. The center of the difficulty was that according to science the world obeys laws that cannot be changed. How can this be reconciled with the doctrine that everything happens according to the will of God? Is not God — and man, too — thus reduced to an automaton?

Both of these incidents grew out of the conflict between physical law and man's belief in freedom. The present generation concerns itself little with the limitations imposed by physics. We think rather of the new possibilities that physics and chemistry are continually opening to us. We are, however, alert to the limitations imposed by biological and psychological factors. We see ourselves acting as demanded by our heredity, our psychological conditioning, and the forces of social pressure. But even such factors are irrelevant if in the mechanics of life things happen as they do because of predetermined physical cause and effect.



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The accepted view among Western scholars until the sixteenth century was that things move because agents make them move. Such was the view of the great Greek teacher, Aristotle. To Greeks and Christians alike, the Unmoved Mover, who makes things go, was one description of God. The remarkably uniform motion of the planets, for example, was seen as evidence both of God's power and of his reliability.

Then came Galileo. His experiments showed that no force is needed to keep objects in uniform motion. The effect of a force is rather to change the motion, to slow it down or speed it up or change its direction. Newton found further that the force of gravity, a universal property of matter, was all that was needed to hold the planets in their orbits. When the significance of these discoveries was fully realized it seemed that all that happens in the world was to be accounted for as a result of the mechanical forces between the particles of matter. A classical statement of this conclusion was made in 1812 by Pierre Simon de Laplace, when he said that everything that happens is the mechanically necessary result of what has gone before, and requires of necessity what will come to pass in the future. Such is indeed the implication of Newton's laws of motion.

This scientific view of mechanical determinism did precisely what had been feared by the Moslem fathers of the twelfth century. The hypothesis of a God that governed the motions of the worlds was no longer needed. He was replaced in people's thinking by mechanical forces inherent in the nature of matter. But the scientists had not only taken away the idea of a God that was free to act as he chose. They had also taken from man his most essential character. Man's idea that his efforts had meaning was an illusion. According to this science that was so successful in explaining the motion of the planets, man's actions had been fixed from the beginning of time. Neither blame nor praise for what a person did was justified. There was no such thing as freedom. All events occurred simply as a result of particles moving under mechanical forces, following their inevitable course.

It is these ideas of mechanical determinism that have shaped much of the philosophical thinking with which we still live.

The fault in this theory of mechanical determinism was not discovered until about thirty years ago. It was then found that the laws of Newton do not describe what happens to the atoms of which matter is composed. It was found instead that the properties of these atoms are such that prediction of what happens to them can only be made within certain limits. The amount of this uncertainty is fixed in the very nature of matter itself.

On my laboratory desk I have two simple devices. The first is a freely swinging pendulum. Its beats are regular, repeating themselves uniformly at equally timed intervals. This pendulum is typical of the objects with which the physicists of Laplace's time were familiar.

The second device is a Geiger counter, responding with a click to each ray that enters it from a near-by capsule of radium. The clicks occur at irregular intervals. It may be that about 100,000 clicks will occur each day. But several seconds may pass without any clicks, while during the next second two or three will occur. Whether in the following second a ray will be counted cannot be foretold. This device responds to the action of individual atoms. Nothing of this kind was known until near the end of the nineteenth century.

The pendulum swings back and forth according to a precise law. The clicks of the counter occur at random.

If such a pair of experiments had been known in Newton's time, it is doubtful whether the idea that events must happen according to precise laws would ever have been formulated. It would have been evident that only under special conditions can one predict definitely what will occur. These conditions are that what we observe shall be the average of a very large number of individual events.

Consider what happens when an atom of radium disintegrates. This event can be recorded by such an instrument as a Geiger counter. The average life of a radium atom is about two thousand years. That is, in any one year from the time the radium atom is first formed, the chance is about one in two thousand that it will disintegrate. It may disintegrate during the present year 1957, but there is roughly one chance in eight that it will remain unchanged six thousand years from now. What the physicists of the twentieth century have shown is that there is no kind of observation that can be made which will tell in what particular year the radium atom will disintegrate. If the atom was in existence six thousand years ago, it was then identical with what it is today. The possibility of disintegration has always been there. Whether it will in fact disintegrate in this particular year is, as far as physics is concerned, a matter of chance — a likelihood of one in two thousand.

There is something comparable with this example in the case of every atomic or molecular event. Thus when light falls on a photographic emulsion, under its stimulus there is a certain chance that any particular grain of silver bromide will be changed so that it can be developed to silver.



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With a given light exposure, this chance may be one in ten, so that on the average about one tenth of the grains will be transformed. But which particular grain will thus be changed is by the very nature of the process unpredictable.

These examples illustrate a point of critical importance in today's interpretation of the physical world. Nature provides nothing whose precise measurement would make possible the exact prediction of an atomic event. On this limitation that nature sets on our knowledge both experiment and theory are agreed. The average of large numbers of atomic events does indeed follow exact laws. In a large lump of radium in one year almost precisely one part in two thousand will have disintegrated. In a square inch of the photographic emulsion, almost exactly one tenth of the silver bromide, after the light exposure, will be reduced to silver. The number of atoms in my laboratory pendulum is huge, roughly a million billion billion. The statistics of the action of such numbers of particles are very precise — even more so when one observes the moon's regular revolution around the earth.

Not all large-scale events, however, are thus precisely predictable. If at any stage the big event depends on some atomic process, the end result shares in the uncertainty of this small event.

A typical large-scale event of this kind is the explosion of an atomic bomb. Such an explosion is triggered by the appearance of a neutron during the particular fraction of a microsecond when the chain reaction must be started. But this neutron comes from a radioactive process, which cannot be precisely foretold. If the chances were only even that during the critical time interval a neutron would appear, there would likewise be only even chances that the bomb would explode. In order that the bomb shall be sure to fire, it is arranged that during the critical time interval some thousands of neutrons will probably be present. Thus the chance of failure becomes practically zero.

Now most of life's processes are like such an atomic chain reaction. They begin with some very small event and grow. They are in fact chemical chain reactions. What starts these reactions in living organisms is not known in detail; but we do know that the beginning is on a molecular, or in certain cases on a submolecular, scale. Thus when I touch something hot and quickly withdraw my finger, the nerve currents that stimulate the muscular contractions are themselves small-scale reactions. The events that are involved when choices and decisions are made have so far defied physical identification; but in all probability they are reactions involving such small numbers of particles that definite prediction on a physical basis is by the nature of things impossible.

As far as physics is concerned, a person's actions which we think of as free would thus appear to occur simply according to the rules of chance. We find nevertheless that in practical life such actions can be predicted when we know the person's intentions. This implies that something additional to the physical phenomena is involved. What we actually note is that in such a case the person has a kind of firsthand knowledge of his own situation that is not gained from any physical observation. This additional knowledge is the awareness of his own intentions. When he acts he feels that he is acting freely. That is, his action corresponds with what he intends.

Thus, for example, I told the editor that I would have this article prepared in time for the present issue of the *Atlantic*. How could I confidently give him this assurance? Was it on the basis of physical data? Only to the extent that it appeared physically possible that the article could be prepared in time. As a physical event an immense number of other possibilities were equally likely to occur. Was not the primary basis of my prediction rather that I knew my own intention? And this I knew, not through any kind of observation, but by an inner awareness; not through a deduction from data, but because of a choice that I was making from among the various possibilities before me.

After thousands of years of discussion among scientists and philosophers, the place of free acts in a world that follows physical law has thus become clarified. There is nothing known to physics that is inconsistent with a person exercising freedom.

A set of known physical conditions is not adequate to specify precisely what a forthcoming event will be. These conditions, insofar as they can be known, define instead a range of possible events from among which some particular event will occur. When one exercises freedom, by his act of choice he is himself adding a factor not supplied by the physical conditions and is thus himself determining what will occur. That he does so is known only to the person himself. From the outside one can see in his act only the working of physical law. It is the inner knowledge that he is in fact doing what he intends to do that tells the actor himself that he is free.

Knowledge of the physical conditions and of the physical laws that apply to our situation thus opens to us a limited range of possibilities for action. Within this range the biological and psychological factors become of ruling importance. That life shall continue and thrive makes certain types of choice self-defeating and other choices so success-



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ful that they become dominant. Hereditary and psychological conditioning make certain types of response difficult and others easy. Much of such conditioning is beyond the control of either the individual or society.

There are physiologists and psychologists who look upon such conditioning factors as compelling. They would say that the choices a man makes are required of him by his nature and his circumstances. Whether this type of determinism in fact exists, the physicist can neither affirm nor deny. Conditions not specified by physical observation are here taken into account. There is nothing that physics knows which would deny the possibility that these conditions determine precisely the action of an individual in a particular situation.

I believe most physicists would, however, agree with me in making this suggestion: Physical laws, which at one stage seemed so exact and compelling, are now found to leave open a wide range of possibilities. May not the physiological and psychological restrictions likewise serve merely to limit further the range and likelihood of the possibilities left open by the physical conditions? If this is true, a choice may still be made from within this more limited range. One may give personal preference to certain relevant psychological factors that affect the course of action. True freedom and responsibility would thus remain.

To this possibility it is evident that the physiologist and the psychologist are unable to give a firm no. The final test for freedom must be one's own sense of doing what he intends. Beyond this test, science has no means of going.

A FEW years ago in Geneva, Switzerland, I met with an international group of some thirty scientists and philosophers, brought together to discuss how man sees himself in the light of science. Is man morally responsible for doing what seems to him good? Can man in fact choose his course? To such questions the response of these men was almost unanimous: Man is free and responsible.

There was one possible exception. He was an Italian student of genetics who was strongly impressed by the effectiveness of inherited tendencies in influencing a person's choices. To myself as a physicist such inherited tendencies correspond simply to a shift in what one scientist calls "the spectrum of action probability." The shift still leaves open the choice of any action that lies within that spectrum.

However, the significant fact was this: whereas in a similar gathering of scientists and philosophers a century or two earlier, freedom would undoubtedly have been denied by a large number in favor of physical determinism, in 1952 with this possible exception not one of the internationally representative group would deny on the basis of scientific law the responsibility that is implied by freedom.

I am not sure that this degree of unanimity would have been present if scientists bound by Communist ideas had attended the meeting. I am told that for a considerable period after the Second World War the teaching of the scientific principle of indeterminacy was under a ban in Russia. Marx, who was a younger contemporary of Laplace, had taught that man is a machine that obeys exact mechanical laws. The scientific idea of physical indeterminacy was dangerous. Who knew? It might open the way to belief that man has some special kind of value, or even to belief in God!

Let me then summarize how a physicist now views man's freedom. It is not from scientific observation that we know man is free. Science is incapable of telling whether a person's acts are free or not. Freedom is not something that one can touch or measure. We know it through our own innermost feelings. The first essential of freedom is the desire to attain something that one considers good. But desire lies outside the realm of science — at least outside of physics. You can't locate desire as somewhere in space. Similarly our recognition that within limits we can do what we try to do is not a matter of measurement or of external observation. It is a matter of immediate awareness. There is nothing in such awareness of freedom that is inconsistent with science. Freedom does, however, involve the additional determining factor of choice, about which science tells us nothing.

For myself, at least, this answer satisfies. Yes, I am free. I say this because I have found in my inner experience that the world does in fact respond to my efforts. And the findings of science, in particular the findings of physics, which at one stage so sharply denied that freedom had any meaning, are completely consistent with this experience.

Thus the way is cleared for our great task. We are free to shape our destiny. In this undertaking we will find our greatest freedom.



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*OTTO FRISCH*

# THE ATOM IN USE

Dr. Otto R. Frisch, *a nuclear physicist who has done research in Berlin, London, Copenhagen, and Los Alamos, is Jacksonian Professor of Natural Philosophy at Cambridge University's famed Cavendish Laboratory. In this article he describes some of the beneficial effects of man's use of atomic energy.*

On December 2 it will be fifteen years since the first man-made nuclear fire began slightly to warm a pile of graphite blocks and uranium rods in a secret laboratory hidden under the west stand of Stagg Field, Chicago. Today the fire is burning vigorously in a number of reactors all over the world: in the United States, in Britain, France, Norway, Sweden, and the U.S.S.R. It is a fire that gets its heat not from the chemical interaction of atoms and molecules, but from the innermost cores of the atoms: from the transformation of heavy atomic nuclei into lighter ones. In that process, enormous energy is freed: ton for ton, uranium is a fuel over two million times more potent than coal. The first uranium-fired power station in the U.S.S.R. has been followed by a much bigger one in Britain (at Calder Hall), where other stations are going up as fast as they can be built. Seagoing vessels have been supplied with this novel kind of boiler, and there is talk of atomic railway engines and airplanes. The atomic age is well on its way.

Will uranium eventually supplant all our other sources of energy? Not in the foreseeable future, I think. In the first place, it is not suited for small vehicles. A nuclear reactor throws off neutrons and gamma rays, both of them dangerous to living organisms; even when it runs at a power of only one watt (about what a flashlight uses) the radiation is above the safety margin. A railway engine or a car needs a hundred thousand times that power, so the reactor must be surrounded by a shield thick enough to cut the radiation down to a millionth or less. Even with the most careful and compact construction, such a shield weighs many tons. For ships, of course, that is all right, and it may be just feasible with a railway engine and perhaps in the very largest airplanes. Ordinary planes and motorcars will no doubt continue to run on gasoline as long as there is some; after that they may run on batteries charged from atomic power stations. But that is a long time in the future, and by then technology may have taken a turn we don't dream of today.

## POWER WHERE POWER IS NEEDED

With a stationary reactor supplying the energy for a power station, the weight of the shield is of course no problem even if it is made from 20,000 tons of concrete, as in Calder Hall. Such a power station, big enough to supply an industrial town of one hundred thousand inhabitants, can be built anywhere provided there is a landing field where the required few tons of uranium a year can be flown in and the used uranium flown out for reprocessing. No longer does one have to site a power station within railroad reach of a coal field, or where a large catchment area provides high-pressure water for driving turbines.

This ability to place power stations where power is needed, however isolated the place may be, will probably be the first great benefit of uranium power. But apart from that, our power demands are going up all the time (it is estimated that they will have trebled before 1980) and our reserves of fossil fuel — coal and oil — are dwindling rapidly. So we must start to replace them by fissile fuel — uranium and later thorium — even though at present it is still cheaper to get power from fossil fuels. The power at Calder Hall is derived from the fission of the isotope U-235, of which



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ordinary uranium contains only 0.7 per cent; and only a fraction of that can be burned up before the uranium has to be removed for purification. But at the same time some of the U-238 — which makes up the bulk of the uranium — is converted into plutonium, which is a fuel as good as or better than U-235, and which can be used to fortify uranium that has lost part of its U-235.

More advanced reactors, still in the experimental stage, will produce more plutonium than the amount of U-235 they consume; once that is achieved, uranium can be gradually more and more fortified, and building compact and efficient reactors will become progressively easier. The process can be speeded up by fortifying uranium with U-235 — that is, by removing some of the U-238 it contains; this is done by pumping a gaseous uranium compound many times through porous membranes, which allow U-235 to diffuse slightly more quickly than U-238. Such diffusion plants — designed originally to help us make nearly pure U-235 for the A-bomb — are now being built to speed the day when they will no longer be needed because the reactors which they have made possible produce enough plutonium to make fortified fuel.

Once we have such "breeder" reactors, we shall also be able to use the much more common element thorium, which — like U-238 — is not nuclear fuel itself but can be converted into the fuel U-233 by cooking in a pile, just as U-238 can be transformed into plutonium. Easily workable deposits of uranium will last for a period of time variously estimated at from fifty to several hundred years; thorium ought to extend that period. After that we may be compelled to work the low-grade ores which contain vastly greater amounts of uranium in very diluted form. Some common rocks, like granite, contain enough uranium to make their energy content comparable to that of coal — a few parts in a million. But extracting such minute amounts of uranium will require enormous factories and will leave mountains of residues.

### SEA WATER AS FUEL

However, before we come to face that unattractive prospect we shall probably have learned to extract energy from an even more abundant source: from water, by fusion of the nuclei of heavy hydrogen contained in it. If we ever master the controlled release of energy by that process (its explosive release is the basis of the H-bomb), our fuel problem would be solved for good and all: sea water would become a fuel a hundred times more potent than gasoline. But the difficulties are vastly greater than with fission: the fusion reaction — as far as we can see at present — will have to be operated at a temperature of many million degrees, and the production, control, and containment of such temperatures — thousands of times hotter than the white heat of an arc lamp — is a stupendous problem. It will probably be a long, hard pull, and I do not expect energy from fusion to gain any large-scale importance during this century.

### RADIOACTIVE RESIDUES

In the meantime fission is our only source of atomic energy, and here we must not forget the radioactive residues, the ashes of the nuclear fire. Fission means that the heavy nuclei of uranium or plutonium break into fragments about half the weight, and those fragments are unstable — that is, radioactive. While they are in the reactor their radiations are stopped by the shield; but every few months or so the uranium must be taken out and purified. Some of the radioactive nuclei formed from fission are highly unstable and will have changed into a more stable form by the time the uranium is out; they present no problem. Others last for some days, and it is well to leave the uranium for some weeks in a safe location — usually at the bottom of a water-filled ditch — until those atoms too have lost most of their activity.

There are some which last for months or years, and one can't wait that long; so the chemical processing has to be done by remote control, some stages fully automatic, others done by operators who use complex long-handled tools and watch what goes on through thick lead-glass windows. And the whole plant has to be built with multiple safeguards so that no conceivable accident could lead to an escape of radioactive stuff into the air, the water, or the ground. When the uranium returns to the reactor, purified and fortified, we are left with a large amount of dangerous radioactive residue which has to be taken into protective custody for an indefinite time since some of the substances contained in it take centuries to become harmless. And the prison where they are kept must be guarded so that no accident — including military bombardment — could release those silent murderers from their jail.

### X-RAYING WITH COBALT

It is a jaundiced view that sees merely the menace in fission products; viewed from a different angle, they are perhaps the greatest boon of the atomic age. Those radioactive substances allow us to do things we couldn't do before.

A radioactive substance is one whose atomic



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nuclei are unstable. While it lasts, such an unstable nucleus behaves just like a stable one; but all the time there is a definite chance that it may suddenly break up, sending out an electron and usually a brief flash of radiation as well. Once that has happened we have a new nucleus which in many cases is stable; but with some substances the new nucleus is again unstable and we must be prepared for another sudden outburst. The radiation which is sent out is called gamma radiation and is of the same nature as X rays. This immediately indicates one use of radioactive substances: to supplant X-ray tubes, which, with their associated electrical equipment, are expensive and clumsy. A piece of radiocobalt, as big as a pea, can replace an X-ray set weighing several hundred pounds. X-raying a boiler to look for flaws in the welding used to be a laborious business; now, with a radiocobalt source lowered into the boiler, X-ray photos of the welds can be obtained very simply by placing X-ray films in the required places on the outside. And there is nothing that can go wrong with a radiocobalt source. Its main disadvantage is that the radiation can't be switched off, and hence a heavy lead shield must be provided to absorb the radiation when it is not needed. Indeed, that shield is apt to weigh more than the X-ray set which the little cobalt source replaces! But there is still the advantage of intrinsic simplicity, reliability, and independence of electrical supplies.

## RADIOACTIVE TRACERS

Let me give you another example in which the advantage of a radioactive source over an X-ray tube is more apparent. Oil pipelines have to be cleaned from time to time, and a convenient way to do that is to insert a so-called go-devil, a scraper that is carried along by the oil flow and scrapes the wall of the pipe as it goes. Occasionally the go-devil jams, and it used to be a laborious business to locate it. Now a small amount of radiocobalt is attached to the go-devil before it is pushed into the pipe; the gamma rays easily penetrate the wall of the pipe and even a reasonable thickness of soil above it, and if the go-devil jams, it can be found quickly by running a radiation detector along the pipeline.

This is perhaps the simplest example of the use of radioactive materials as tracers — that is, for tracing the movement of something that is otherwise hard to trace. And from a go-devil some feet in size there is only a small step to the tracing of sand particles in tidal waters. The movement of sand at the bottom of a harbor is of great interest for the planning of future dredging requirements, and this is now studied with the help of artificial, radioactive sand having grains of the same mean size and density as the sand whose movements we wish to follow. This tracer sand is put down at selected points, and some days, weeks, or months later, samples are taken up in various places. By measuring how strongly radioactive they are, one can find out how much of the artificial sand they contain and hence how the sand has moved.

## RADIOISOTOPES

The most important and dramatic application of radioactive tracers is their use in the study of the metabolism of living beings, underlying the growth of living tissues. What we need here is not counterfeit grains of sand but counterfeit atoms, chemically identical with those whose metabolism we want to study and yet recognizable by some simple test.

In 1907 two Chicago chemists, Dr. Herbert N. McCoy and Dr. William H. Ross, reported that after mixing two different radioactive substances, thorium and radiothorium, it was impossible to separate them again by any of the chemical methods they had tried. Similar reports soon came in from other laboratories. Most chemists were slow to accept those reports, based on the study of unweighable amounts of substances that could be detected only by their radiation; "chemistry of phantoms" they derisively called it. But by 1913 enough evidence had accumulated to make the British chemist Soddy coin a new word, *isotopes*, for denoting those variants of a chemical element. About the same time the physicists discovered supporting evidence, based on quite different techniques, and within a short time all doubts had disappeared; the "chemistry of phantoms" had become respectable, and workers crowded into this new and exciting field.

While most of them were trying to understand what isotopes meant for the inner structure of atoms, the young Hungarian chemist Georg von Hevesy saw them as a potential tool for the research chemist and biologist. He acted somewhat like the legendary businessman who made a fortune by selling an ineffective Hair-Growth Promoter in bottles labeled Hair Remover: he saw that the very impossibility of separating isotopes could be turned to good account.

Around 1920, scientists were arguing about the question: did atoms in solid matter stay put, or did they occasionally change places? There was some indirect evidence (for example, from electrical conductivity) that they did move about, but the question couldn't be decided directly unless you could tell one atom from another of the same kind. Hevesy placed a layer of a lead



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compound in intimate contact with a layer of the same compound of his mixture of lead and radium D (a radioactive isotope of lead). At room temperature the layers remained sharply defined, but at higher temperature diffusion took place as expected: when the specimen, after a period of heating, was sliced up some radioactivity was found in the previously inactive parts.

By studying many specimens, heated to different temperatures for different times, it was possible to elucidate how the atoms worked their way through the solid. Since all attempts to separate lead and radium E chemically had failed, one could feel sure that their atoms would move in the same way. That was one of the first instances when atoms of radium E were used deliberately as counterfeit lead atoms.

At first the method was limited to lead and few other heavy atoms, but in 1934 the discovery of "artificial radioactivity" made radioactive isotopes of many light elements available. The amounts were small, but very sensitive measuring instruments such as the Geiger counter had come into existence at the right time; indeed, without that invention (about 1928) artificial radioactivity might not have been spotted for a long time, since only minute amounts of radioactive isotope are formed when light elements are bombarded with the alpha rays from radium or its like. Much greater amounts were soon made with the help of the newly invented cyclotron, and a much wider selection could be made through the intermediary of neutrons, also discovered in 1932.

Several years of intense development culminated in the discovery of nuclear fission in 1939, and the war hastened the construction of the first atomic pile. With that, the output of radioactive material was raised a millionfold, and the tracer method became available to any scientist who wanted to try it.

The discovery of isotopic tracers might be compared, in its character and importance, with the invention of the microscope. In each case there was no immediate benefit to health or happiness. But the microscope showed us the existence of small living organisms whose existence had not been suspected; and from there it was not far to the recognition that some of those organisms were causing illness, and to the systematic attack on the enemy once recognized. Isotopic tracers have increased our range of observation by another large factor: though we can't see atoms, we can now follow their motion through a living organism and obtain entirely new insight into its functioning. Today, germs have ceased to be the principal enemy; the chief causes of death and suffering now are those diseases — like rheumatism or cancer — in which the organism's inner balance is upset. To understand and prevent those upsets we must first understand how the balance is kept in the healthy organism, and here isotopic tracers will be one of the principal tools.

As always with the first steps in a new direction, some of the experiments now in progress seem disappointingly remote from the cure of human illness. You may for instance find a scientist engaged in growing plants in an atmosphere containing carbon dioxide in which some of the carbon atoms are of the radioactive isotope C-14 (C is the chemical symbol for carbon; 14 is the atomic weight, rounded off to the nearest whole number). After a certain time he will dissect the plant and from its various parts extract a number of chemicals which he will then test with a Geiger counter. In this way he can learn a great deal about photosynthesis, the process by which the plant builds up many of its chemicals from carbon dioxide and water, using light to supply the energy needed. He can find out which chemicals are formed first and which later, and which processes can go on in the dark and which require light. Much of what we now know about this most fundamental life process has been discovered in this manner. He can also regard his plants not only as an object for study but as a factory for the production of labeled chemicals. For instance, the sugar which his plants produce will contain C-14 and can in turn be used to study the sugar metabolism of other organisms, including humans. This might eventually lead us to a more satisfactory cure for diabetes than we have now, when the insulin which the patient has lost the ability to produce must be supplied to him at frequent intervals, and usually for the rest of his life.

### THE STRUCTURE OF LIVING TISSUE

From such studies we have already learned that a living organism is far from being a static structure. It is not, so to speak, a house to which a wing may be added in time of plenty, to be torn down again when there is a shortage; it may rather be compared to a shop with a rapid turnover where each tin or package stays on the shelf for a short time only, to be replaced by an identical one as soon as it is sold. This had been expected for the chemicals contained in the body fluids, but it came as a surprise that even the proteins, those complex chains of carbon and nitrogen from which, for instance, our muscles are made, are undone and replaced every few days.

A great deal about the mechanism of this process has been found out by the use of isotopic tracers. The tracer used here, the nitrogen isotope N-15, is not radioactive but is present in



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small amounts in ordinary nitrogen, which consists mostly of N-14. It is not made in a fission reactor and has indeed been known for a number of years. But the need to separate the uranium isotopes U-235 and U-238 on a large scale stimulated the construction of equipment which can now be used to separate N-15 and other isotopes in practical quantities from their natural mixtures. In that sense even the use of non-radioactive tracers such as N-15 for nitrogen and O-18 for oxygen is a product of the effort that went into the exploitation of nuclear fission. The reason we have to use non-radioactive tracers which require for their detection a fairly expensive instrument, a mass spectrometer, is that all radioactive isotopes of oxygen and nitrogen are so unstable that they decay in a matter of minutes, too fast for use in most biological experiments.

It is often asked whether the introduction of a radioactive material into an organism doesn't affect it through its radiation. The answer is that usually there is no difficulty in keeping that effect negligibly small. This is so because a Geiger counter records single quanta of radiation and is thus many thousand times more sensitive than an organism. True, one radiation quantum can modify the nucleus of a germ cell sufficiently to cause a mutation, an inheritable change of character; but only one in many million quanta will score that kind of bull's-eye. With rare exceptions the experimenter has very comfortable room for maneuver between the smallest radioactivity that he can detect and the biggest that the organism will tolerate.

That margin is often used to employ photographic methods which are less sensitive but much more informative than Geiger counters. A leaf grown, say, from soil containing radiophosphorus (P-32) is pressed onto a photographic plate and will then print its own picture, blackening the plate where the radioactivity has penetrated along the veins in its structure. It is even possible to embed cells in a special photographic emulsion and, after developing, to trace the fine crooked tracks of the individual electrons back to the cell they came from, under a microscope, and thus to discover which part of a cell that is invisible to the naked eye had accumulated the tracer.

## HUNTING FOR CANCER

Certain chemical compounds have been found, by the use of tracer techniques, to become attached preferentially to cancerous tissue, and they can be used as bloodhounds: introduced into the bloodstream of a patient, they will seek out any cancerous growth and thus render it liable to detection with a counter. For finding deep-seated growths in that manner, one can use one of the tracers that emit, not ordinary negatively charged electrons, but positrons; such a positron, after traveling a short distance, will undergo mutual annihilation with one of the ordinary electrons present in all matter, and the result is two quanta of gamma radiation, flying apart in exactly opposite directions. Two counters, say one above and one below the patient, will then record simultaneous arrivals of quanta in both counters, but only if their source — the looked-for growth — lies on a straight line with the counters, and by tilting that line the growth can be accurately located even deep inside the patient.

There is some hope that those bloodhounds may be trained not merely to spot the game but also to kill it: that strongly radioactive preparations could be made which would become almost exclusively attached to the cancer and would then destroy it by their radiation. So far, the efficiency of only one organ (the thyroid) in concentrating one element (iodine) has been found high enough to allow destruction of that tissue without damage to the rest of the body.

The destruction of cancer can of course be done from the outside, by irradiation with X rays or gamma rays. This well-established radiation therapy brings us back to the beginning: X-ray tubes and radioactive sources compete on roughly equal terms, as seen from the fact that hospitals all over the world continue to buy both kinds of radiation sources. The same competition exists in other applications of strong radiation — for instance, for killing germs in the sterilization of food or medical supplies, for the toughening of plastics, the improvement of transistors, or the removal of electrostatic charges from moving belts, paper, or cloth.

Radiation can also be used to fight certain insect pests where the female only mates once: males are reared in the laboratory, sterilized by radiation, and then released before their wild brethren, when they will mate with many females, causing them to lay eggs that won't hatch. New applications are being invented all the time; X-ray tubes will be most economical for some of them, radioisotopes for others. Here is medical and technological advance on the move right now.

But in the long run, I think, it is the large-scale use of isotopic tracers that will come to be regarded as the main scientific advance of our time. It will not supplant but supplement the earlier tools of the scientist. Already it is used not only in biology and medicine but also in agriculture and engineering. But in particular it will give us vastly greater insight into the functioning of life processes, and thereby we shall be able to make the earth more healthy, fertile, and beautiful.



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# THE WONDERFUL CENTURY

*by I. BERNARD COHEN*

*The* ATLANTIC'S *hundred years have seen science and technology transform our world not once but repeatedly.* BERNARD COHEN, *Harvard's distinguished historian of science, tells the story in terms of the very different worlds of 1850, of 1900, and of 1950.*

THE achievements of the nineteenth century in science and technology — "especially as regards man's increased power over nature, and the applications of that power to the needs of his life" — were described in 1898 in terms of an "importance and grandeur" never known before. It seemed as if so much had been accomplished in a hundred years that there was hardly any basis for a comparison with what man had done "in any preceding century . . . perhaps even . . . the whole period that has elapsed since the Stone Age." The author of these phrases, Alfred Russel Wallace, wrote with a sense of participation in the accomplishments of what he called "the wonderful century," since he was an independent co-discoverer of the principle of organic evolution by natural selection.

In order to prove his point, Wallace enumerated the major inventions and scientific discoveries from the Stone Age to the end of the eighteenth century and compared them with those made during the nineteenth century. It may seem surprising that he listed "lucifer matches" (or friction matches) among the great inventions of his time. Yet Wallace could recall that in his boyhood the first morning's task had been to search among the ashes in the fireplace for a glowing coal from the previous evening's fire. If he failed to find one, it would be his job to go to a neighbor's house with a bucket to "borrow some fire" — a procedure that had not changed appreciably since the Stone Age.

High on his list of major inventions Wallace placed the railroad and the steamboat, and the conveyance of intelligence by the application of electricity to the telegraph and telephone, enabling men to send messages faster than the wind over continents and even oceans. Finally he drew attention to the revolution in illumination: gas lighting and the new infant prodigy, illumination by electricity.

Reviewing the list of inventions made in the nineteenth century, we cannot help noticing that they were largely the products of mechanical ingenuity rather than the results of the application of newly discovered scientific principles and that, furthermore, they were not produced by organized or systematic research. Even the telephone and the telegraph, though both harnessed the power of the electric current (discovered in the opening year of the nineteenth century), did not depend for their operation on any principles that were not generally known. Neither Samuel F. B. Morse nor Alexander Graham Bell had or needed a profound knowledge of the latest advances in electrical science.

But today we take it for granted that large-scale scientific research and development are the necessary conditions for technological, agricultural, and medical progress. A hundred years ago science was not yet conceived to be the pathfinder of the practical arts, and even fifty years ago it was not the custom for industrial concerns to support large-scale research establishments, or for governments to expend huge sums of money in scientific research for public health or national defense.

A few years ago, on a visit to the laboratory of the General Electric Company in Schenectady, I



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met Dr. Willis R. Whitney, the founder of this laboratory and its first director. Dr. Whitney was still busily engaged in research, as was his successor, Dr. William D. Coolidge. The then director of the laboratory, Dr. Guy C. Suits, was the third in the line of succession. Thus the whole history of this laboratory was encompassed by the span of three careers and the active life of a single man. So new was the idea of industrial scientific research at the beginning of the present century that when Dr. Whitney accepted the new post at General Electric, he suggested that he retain his professorship at M.I.T. on a half-time basis. Today it seems inconceivable that he could have believed the new job would not occupy a man's full time.

Because scientific research today conditions our health, our standard of living, our national wealth, and our military security, the scientist is no longer — as he still was in the nineteenth century — an academic recluse who can spend his days in ignorance of the travails of society or its pressing needs. Darwin could live out his life in solitude and in isolation, for he did not have the experience that Einstein had of being aware that his additions to knowledge might provide the basis for a new weapon, a new technology, or a new approach to any of the practical problems of the world.

In chemistry we see the dramatic demonstration of how even the most abstract and theoretical advances might be applied to practical purposes. Modern scientific chemistry dates only from the "chemical revolution" associated with Lavoisier at the end of the eighteenth century. By the middle of the nineteenth century, the question was not yet fully resolved as to whether the compounds found in animals and plants could be made synthetically in the chemist's test tube or whether they required for their manufacture some sort of "vital force." The chemists, their imaginations fortified by new methods of analysis, began to envisage the synthesis of living substances in their laboratories and even the production of wholly new substances with more useful properties than those found in nature in plants and animals. In 1856, a young chemistry student, William Henry Perkin, devoted his Easter holiday to synthesizing quinine — that is, to producing quinine in his test tube from aniline, a product of the distillation of coal to make illuminating gas. That the eighteen-year-old student failed in his endeavor is not surprising. But the experiment that failed yielded a colorant of mauve hue, the first synthetic, coal-tar, or aniline dye.

At the time of Perkin's discovery, the sources of coloring matter for dyeing cloth were still chiefly of animal and vegetable origin. Black dye was obtained from logwood, blue from the indigo plant, and "Turkey red" or alizarin from the roots of the madder plant. Animal dyes were obtained from such insects as the kermes and cochineal, while the most famous and most costly, "royal Tyrian purple," was squeezed one drop at a time from the Mediterranean shellfish *Murex brandaris* — 12,000 shellfish yielding only 23 grains of coloring matter. The beautiful purple dye mauve, synthesized by Perkin in 1856, was not found in animal and plant material, and its discovery opened up to the chemist the possibility of creating an endless variety of colorants whose hues would outrival nature herself.

In 1858, Perkin made a second revolutionary discovery: he synthesized alizarin. Starting with coal tar, he made in the laboratory a chemical substance in every way identical with the alizarin then obtained from the madder plant. Until about 1870, some 400,000 acres of arable land in Southern Europe and Asia Minor were under cultivation for the production of alizarin, France alone having 50,000 acres devoted to growing the madder plant. From this natural supply, there were obtained some 750 tons of pure dye. But by World War I, 2000 tons were being produced synthetically in chemical plants, and madder had become a botanical curiosity of no commercial importance. At the same time the cost of the dye had been greatly reduced, since the chemist found he could make alizarin more efficiently than nature could. The sudden change in the economy of the madder-producing regions showed, for perhaps the first time, the vast social consequences of a single scientific discovery.

Even more dramatic was the story of synthetic indigo. The source of the world's indigo until the end of the nineteenth century was India, where over a million acres were set aside for the dye-producing plant. In 1897 India produced more than 8000 tons of indigo dye, which yielded an annual income of about $20 million. But by 1914 India had only a few thousand acres still devoted to indigo culture, and Germany had achieved a 96 per cent monopoly. What had happened between 1897 and 1914 was that Germany had captured the market by the force of research in organic chemistry.

The exact composition and structure of the indigotin molecule (the active coloring part of indigo) was elucidated by the German chemist Adolf Baeyer after about fifteen years of research, and in 1880 he produced a small quantity synthetically in his laboratory. Baeyer's method of synthesizing indigotin was a triumph of pure science and showed the power of the new organic



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chemistry. Yet the initial cost of making indigo dye in this way so far exceeded the cost of obtaining the dye from the indigo plant that Baeyer's achievement must have appeared to many practical men as an academic curiosity. Germany was then a rising national power, and the great British indigo monopoly in India appeared a prize well worth capturing. For seventeen years German chemists worked to find a way to make synthetic indigotin cheaply, and some $5 million was spent before the new product was ready for the market. This was the first large-scale program of organized applied research in history.

After the event, one of the foremost German chemists claimed that the success of this unprecedented venture was due to some special "moral" qualities possessed by German science and required specifically for research in organic chemistry. Delivered at a dinner in London to honor Perkin and to celebrate the fiftieth anniversary of the discovery of mauve, this German address must have outraged the British scientists, who were told that they could pursue inorganic chemistry but that they lacked the "moral" qualities that had enabled German organic chemists to wrest the dye industry from the British grasp.

Germany was the first to give a convincing demonstration of the decisive role that long-term applied scientific research might play in the economic contests between nations. Furthermore, the gigantic growth of the synthetic dye industry in Germany was not without military consequences. Since unstable dyes are explosives, Germany had built up before 1914 the vastest potential explosives industry the world had ever known.

Since that time it has been clear that no nation can face the future militarily or economically without a sound system of applied scientific research.

Apart from its effects upon society, the most striking difference between science as it was a hundred years ago and as it is now is the sheer magnitude of the enterprise. In 1800, scientists still published their discoveries in books and pamphlets or in the proceedings of learned societies or academies, such as the Royal Society of London, the Academy of Sciences at Paris, or the American Philosophical Society.

In 1857, it was still possible for a scientist to read all the articles published in his field. Today the physical magnitude of such a job would make it quite impossible. Shortly before World War II, there were about 50,000 scientific periodicals published throughout the world, involving the publication of about 1,000,000 articles a year or 20,000 per week. The number has greatly increased since then, and it may be conjectured that now at least some 30,000 scientific articles are published every week. Such is the colossus of present-day science.

A CENTURY ago two contrasting ideas stirred men's minds. The first was the doctrine of conservation of energy, announced in 1848; the second, the doctrine of evolution through natural selection, announced in 1858. Each of these concepts was a product of multiple discovery, three independent investigators claiming the conservation of energy and two conceiving independently the doctrine of evolution through natural selection. The bare fact that each of these major discoveries was made simultaneously and independently by two or more investigators shows us the closeness of the chase with which scientists pursue similar ideas, which has become a rather constant feature of modern scientific enterprise.

The doctrine of the conservation of energy was very important for the contemplation of the life of man, because it implied that the total energy of the universe is constant, that no new energy will be created. Following the principles of thermodynamics, the present store of available energy will gradually be used up or transformed into a lower or "degraded" state, where it will no longer be usable. According to this sober doctrine, therefore, the life of the universe insofar as man is concerned is finite and limited, and it is even possible to predict the date on which life as we know it on this earth must cease to exist — when the sun's energy will fail, as it ultimately must.

A conservative doctrine, this principle implied a constancy in the universe. Human events, such as those that marked the year 1848, in which the principle was announced, might betoken change and instability, but the guiding principle for understanding the universe, its very regulating principle, was constancy. How this contrasted with the doctrine of evolution by natural selection! Here was a law of continuous change, which stated in effect that even the forms of life were not constant, but had evolved through centuries. This new doctrine bespoke the limitless possibilities of variation and the survival of those variations most suited to their environment. Evolution thus implied a dynamic world of almost infinite possibilities of change and so ran counter to general modes of thought in the mid-nineteenth century. Much more harmonious with the generally accepted world view was the point of view of the physical scientist, who saw all change as mere rearrangement of the matter, motion, electric charges, and energy that had existed since the beginning of the world.



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The harmonious world of physics did not last very long. By the decade 1895–1905, the basic principles of classical physical science had been shattered. This decade saw events that threatened the foundations of the biological sciences, too. Probably the major discovery in the life sciences at this time was in the field of genetics. In 1900 the laws of genetics were established independently by Correns, Tschermak, and De Vries. To their amazement each of these co-discoverers soon found that he had been anticipated by the work of an Augustinian monk named Gregor Mendel, whose careful experiments and theoretical deductions had been published in 1865 and had nestled comfortably in the literature like a butterfly in its cocoon — present but out of sight. One of the reasons for the neglect of Mendel's work is that it must have seemed out of harmony with the ideas of evolution. Mendel emphasized a conservative aspect of plant and animal societies, a tendency toward constancy rather than change or variation, which is a necessary condition for evolution. In Mendel's experiments one could discern the constant heritable characters which might disappear for a time in hybrids only to reappear again unchanged. It was almost as if the physical basis of heredity were a set of particles which maintained their identity somewhat as atoms do when they combine to form molecules. In the last fifty years the work of Thomas H. Morgan and his associates, and of Curt Stern, Theodosius Dobzhansky, C. D. Darlington, and others, has firmly established the theory of the gene (as the unit of the Mendelian factor is now called).

Today the study of genetics is a major part of the subject of evolution. But in the first years of our century the establishment of the principles of genetics seemed to threaten the foundations of evolutionary theory. If a new variation or mutation were to appear in nature, and if it were adapted for survival, genetics could account for the transmission of the new characters; but how could these new characters have appeared in the first place if heredity is governed by genes? In part this question has been answered by the realization that the genes produced in each plant or animal, which transmit the heritable characters to the individuals of the succeeding generation, may on occasion be imperfect copies of the prototype; the result will be an alteration of the character or characters controlled by that gene in future generations. This new gene will remain constant through generation after generation until it mutates once again. Since, as H. J. Muller discovered, the frequency of mutation is increased by X rays and radioactive radiation, one can readily understand the concern of many scientists lest a rise in the radioactive level of the earth upset the normal process of evolution and rapidly produce mutations which may survive even though they may have undesirable but heritable characters.

One of the great puzzles of present biology is why genes should be so stable — why mutations do not occur more frequently. It is generally agreed that the gene is a very complex protein molecule; if so, how does it come to be "copied" so exactly from one generation to the next? The protein molecule itself, the fundamental structural unit of living matter, is not yet very fully understood. We have not, for example, been able to synthesize the natural proteins in our test tubes. But some of the other mysteries of living matter have, in the twentieth century, been resolved by the methods of science.

One of the greatest mysteries in science at the end of the nineteenth century was the cause of the apparent heat in radioactive substances. A small block of radium is always one or two degrees higher in temperature than its environment, and this is true whether such a piece of radium is kept at room temperature, placed in boiling water, or put in a deep freeze. According to the established principles of conservation in physics, energy is never created or destroyed, but is only transferred or transformed. Heat energy in particular is always transferred from hot bodies to cold bodies, so that a hot body will always lose heat until it reaches the temperature of its environment. This was the line of reasoning that led to the notion of the "heat death" of the universe, the heat energy of the sun and the stars being transferred to colder bodies in the solar system and to the colder environment, until eventually the available heat becomes degraded throughout the whole of space. From the classical point of view, to produce energy on this earth it is necessary to have a source; hence if a piece of radium stays hotter than its environment, it must either receive the heat from somewhere else or produce it by means of chemical action such as the burning of coal — neither of which can apply. In radium, energy appeared in an unlimited quantity and seemed to have been created *ad hoc*.

Even more disturbing was the observation that these mysterious radioactive substances — chiefly uranium, thorium, radium, polonium — seemed to have some power within them whereby matter was destroyed. A uranium atom suddenly dies and in its place there appear a thorium atom and a helium atom. Not only did matter seem to be able to change spontaneously from one kind of chemical material into another, contrary to all established rules, but this process proved to be one



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that was regulated by chance and the laws of probability rather than by the causal or determinative principles. If causality were to apply to radioactive disintegration, it would be necessary that the uranium atoms which disintegrate be noticeably different from the uranium atoms which do not disintegrate; but all of man's art in exploring physics has not been able to show that there is any discernible difference between the atom of uranium that will die in the next minute, the one that will die one year from now, and the one that will not die until one hundred years have passed. All that can be said about the death of uranium or radium atoms is that each one has the same statistical probability of death and disintegration as any other — that according to the laws of pure chance fate selects some atoms rather than others to die and leave wholly new kinds of atoms in their places.

In a sample of radioactive material, the first appearance is that energy is coming from nothing. Such is not really the case. What actually happens is explained by the theory of relativity of 1905, in which Einstein showed that energy and mass are related by the famous equation $E = mc^2$. It is now held true that energy is not always conserved, that energy may disappear, and that energy may be created; but whenever energy does appear or does disappear, there must be a corresponding loss or gain in mass. Thus what seemed originally to be a simple violation of the principle of the conservation of energy turned out to be but the first example of a wider conservation principle, according to which neither energy nor mass (matter) is conserved by itself, but according to which the total amount of matter and energy *is* a constant within any given system.

The notable equation relating mass and energy was but one of the results of the famous theory of relativity of 1905, the others being the conclusion that space, time, and matter have no meaning in an absolute sense — that space (in the form of distance) and time can only be measured relative to an observer. The result is that if two systems or frames of reference are in relative motion with respect to one another, the observable quantities of size and shape, and of time and matter, cannot be conceived in independence of the relative motion. The conclusions of this theory are confirmed daily in cyclotrons and other particle accelerators throughout the world, and in every nuclear reaction produced in the laboratory. This particular theory has had a greater popular appeal than any other scientific theory in the history of thought with the exception of Darwinian evolution and Newtonian mechanics.

It may seem surprising, therefore, that according to Einstein himself, it was another theory of the year 1905 which was truly revolutionary. Many physicists had almost hit upon the theory of relativity when Einstein announced it in 1905, and Einstein said that if he had not published the theory in that year, it would shortly thereafter have been discovered by the French physicist Paul Langevin. But the theory of photons, published by Einstein in that same year, would not have been discovered by anyone else, at least not for a number of years. How revolutionary that theory was can be seen in the fact that it took about twenty years for it to become generally accepted by physicists, and its implications are not even fully clear at the present time. It involves the basic dualism between the continuous and the discontinuous, between wave and particle, and marks the beginning of our complete inability to conceive the minute physical world on the atomic scale in terms of mechanical models or pictorial concepts of tiny billiard balls.

The triumphs of modern physics have been of a magnitude without precedent in the history of thought. Thanks to the labors of J. J. Thomson, Rutherford, Bohr, and their pupils, we have penetrated within the atom and we have succeeded in tapping the resources of energy stored in the atomic nucleus. We have even realized the alchemist's dream of changing one type of chemical element into another. But I believe that anyone who appreciates the growth of scientific thought will consider the most interesting aspect of science in our time to be its mysteries. In physics there are the as yet unknown forces that hold the parts of the atomic nucleus together and the question of the meaning and function in the scheme of nature of the rapidly growing number of known cosmic particles. In biology there is still the problem of the basic chemistry of life, and in astronomy the mystery of the outer reaches of space and the creation and destruction of matter.

There are some among us who envisage a time when all the major questions will be solved. But the history of science to date would rather indicate that as long as the human imagination may contemplate the world of nature, the solution of one problem will always give rise to another problem of a different sort. The more experiments that we perform, the greater is our respect for the creative mind of man which can invent a "natural order" to encompass the data of experience in a systematic array. Today it seems clear, as it did to men at the birth of science, that in the pursuit of science, truth is a direction rather than a destination.



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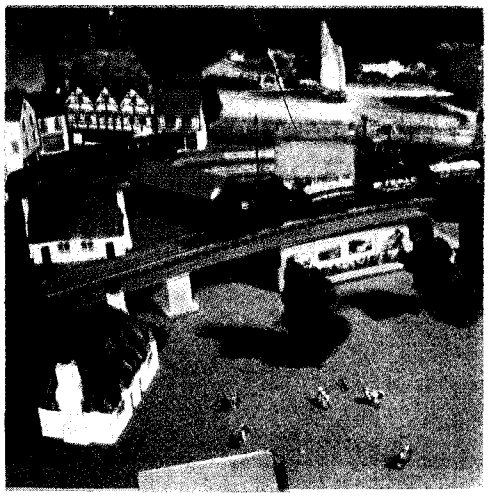

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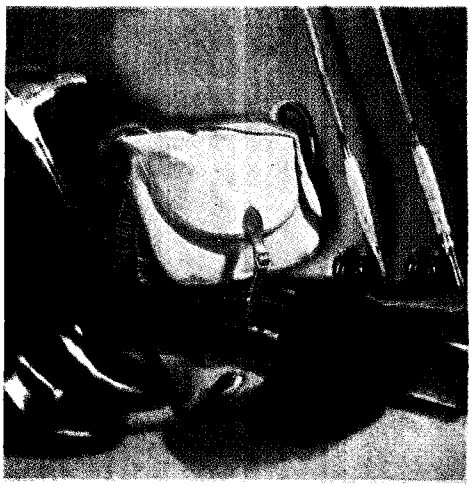

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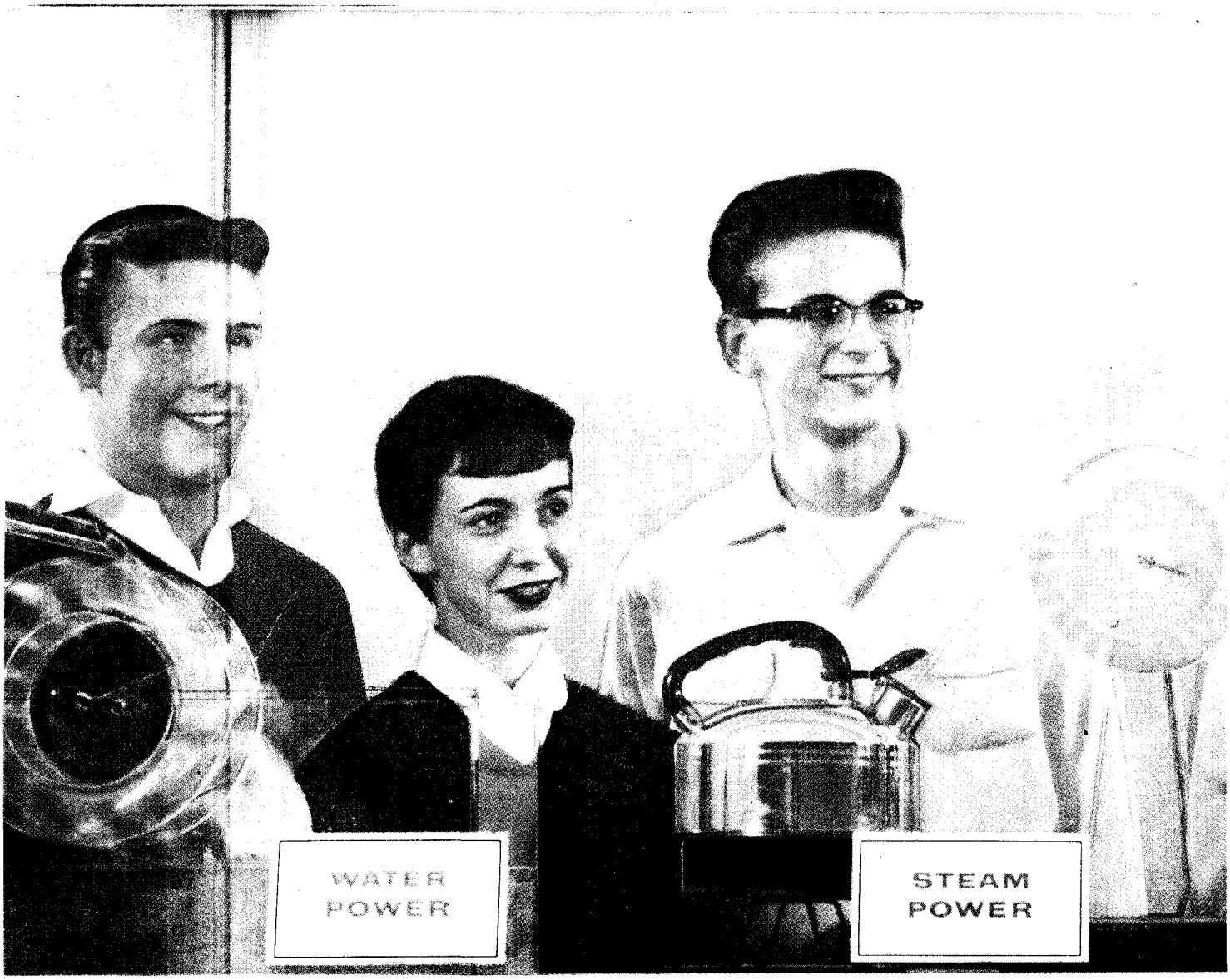


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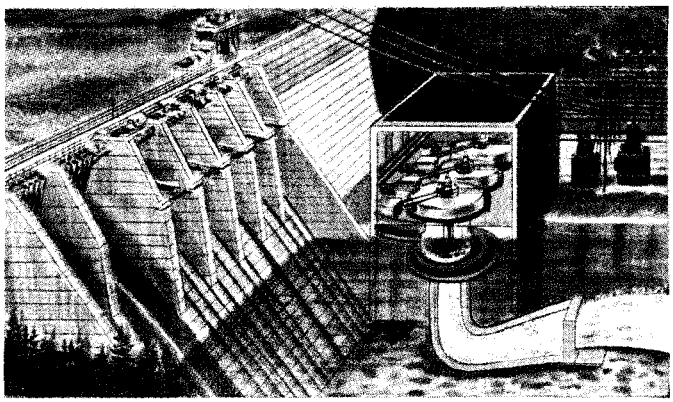

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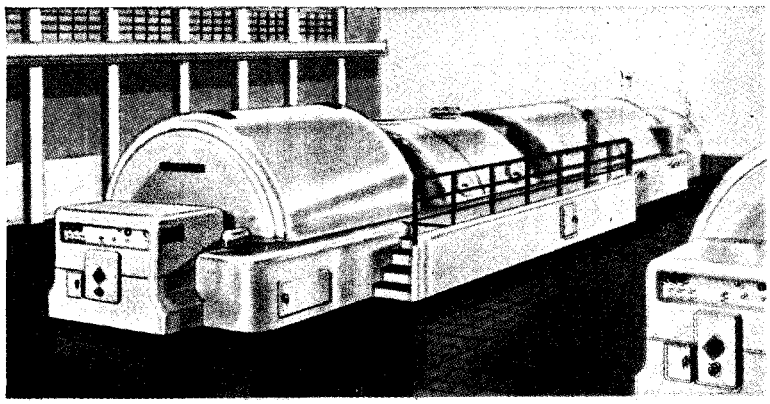

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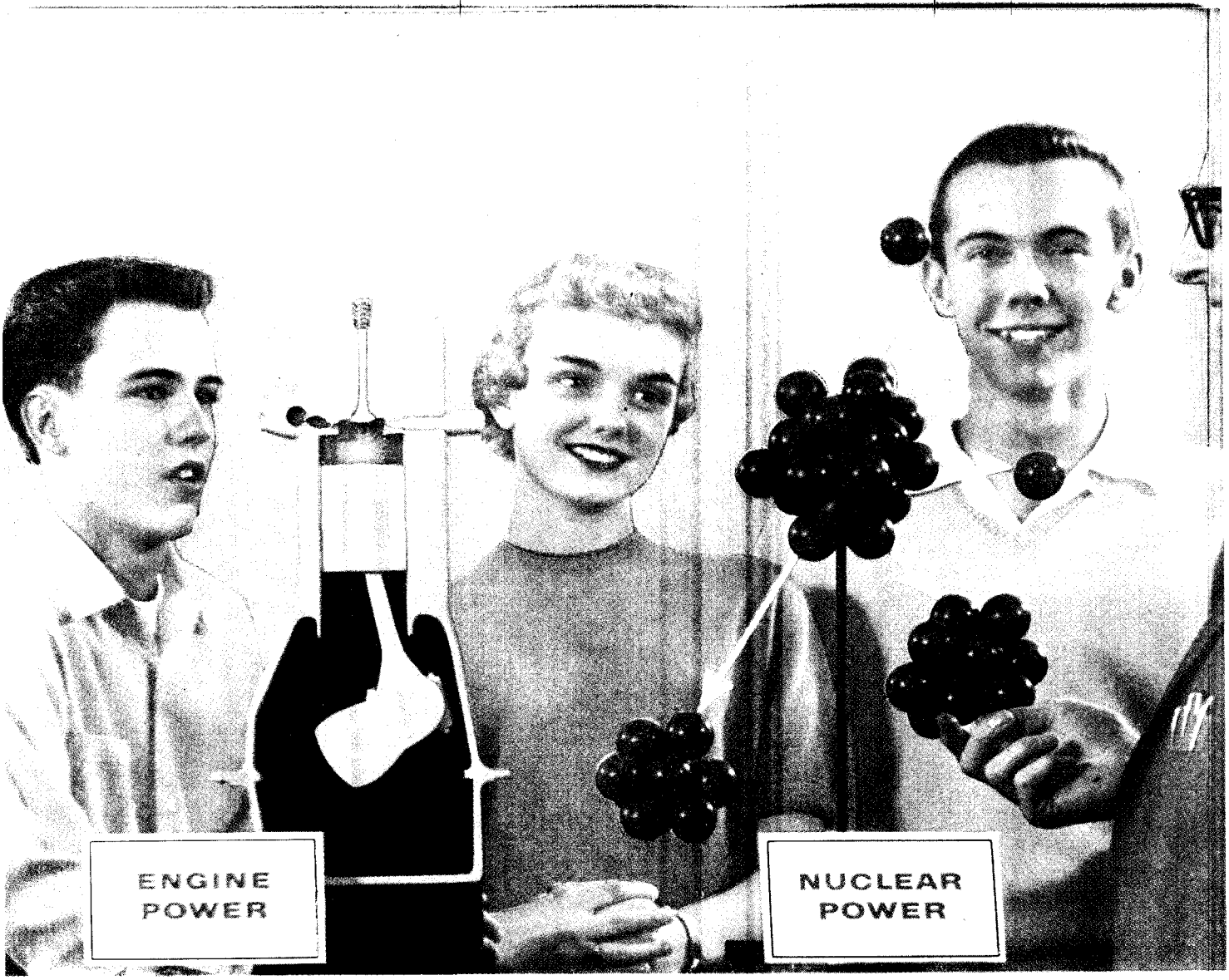


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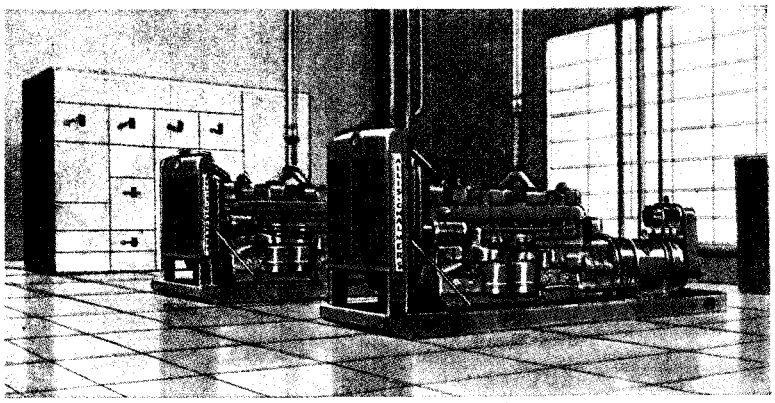

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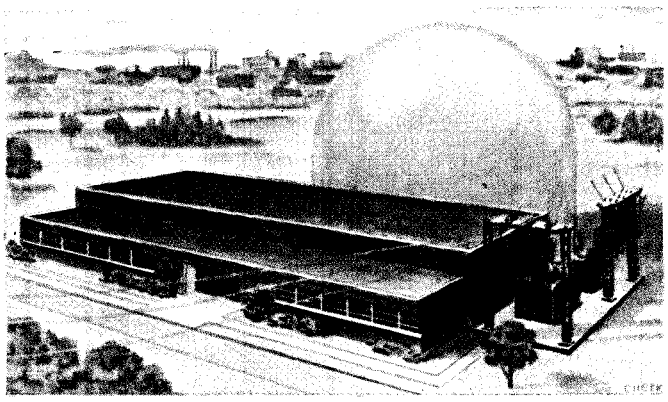

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# THE FUTURE OF FLIGHT

by LOUIS N. RIDENOUR

*A key figure in the development of radar and now head of Lockheed's missile development,* LOUIS RIDENOUR, *in this highly readable article, reviews the record of human flight and tells what lies ahead as the engineers enable men to fly higher and faster.*

THE envy of birds is very old in human history; the fable of Daedalus and Icarus has come down to us from classical antiquity. Leonardo da Vinci, perhaps the greatest innovator who ever lived, dealt with the problem of flight. Observing the flight of birds, he invented the ornithopter, but he also had a remarkably prescient appreciation of the basic aerodynamic problem. Ignoring Aristotle's wrongheaded idea that no moving body could continue to move without the continued application of force, Leonardo correctly assumed that support by the air is possible only because the air resists motion through it. This sounds paradoxical, but it is not. Lift, which is required for sustained flight in a heavier-than-air machine, can be achieved only at the cost of incurring drag, which has classically been the main problem of such machines. Leonardo understood this, though it was not generally recognized until four centuries later.

Man first got off the ground in an aerial vehicle — actually a hot-air balloon — on November 21, 1783. This historic first flight was followed by many others, and by development of the dirigible balloon which reached its apotheosis in the German *Hindenburg*. Long before the *Hindenburg* exploded and burned at Lakehurst on May 6, 1937, carrying thirty-six persons to their deaths, it was clear that the buoyant airship was not the best means of aerial transport.

In the history of man's endeavors to fly, there are four chapters, of which only the first — lighter-than-air craft — antedates the *Atlantic*. The Wright brothers' first flight in a heavier-than-air machine was made on December 17, 1903, at about the mid-point of the *Atlantic's* first century. Supersonic flight in the air, the third chapter, began toward the end of the *Atlantic's* century, and flight out of the atmosphere in ballistic missiles, which has scarcely been begun in 1957, appears sure to follow soon.

In considering the past development of human flight, the lighter-than-air machines will here be dismissed, because it now appears that heavier-than-air machines have much greater present and future significance. Intrinsically, lighter-than-air craft suffer from the fatal defect that the greatest speeds of which they are capable can be matched in surface transport. For most military and commercial applications, this is a decisive shortcoming. This judgment may be wrong; the use of beryllium as a structural material and the introduction of nuclear power sources may ultimately render lighter-than-air craft competitive for some military or commercial purposes. Still, those possibilities seem so distant and so unlikely that they can be ignored.

The history of heavier-than-air machines can be started with a variety of investigators, but perhaps it is fairest to begin it with Sir George



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Cayley, who in 1809 put forward clearly the novel concept of using as a lifting device a fixed wing rather than flapping wings like those of a bird.

During the nineteenth century, development and application of the fixed-wing principle of Cayley continued. Model experiments and trials of unpowered gliders were carried out by many investigators. Otto Lilienthal of Germany was the greatest of the glider pilots; he made hundreds of successful flights before he crashed to his death in 1896.

Samuel P. Langley, secretary of the Smithsonian Institution, was interested in the development of a man-carrying aircraft. He experimented with powered models, and finally designed and built an "aerodrome" (literally, air-runner) which in 1896 flew for about half a mile over the Potomac River near Washington. A later aerodrome of Langley had as a power plant the first liquid-cooled radial internal-combustion engine to have been developed. It produced 52 horsepower at a total weight of 125 pounds, and was thus well ahead of its time.

Orville and Wilbur Wright, the proprietors of a bicycle shop in Dayton, Ohio, had been interested for some time in the problem of powered flight. With the helpful advice of Octave Chanute, who had followed with interest Lilienthal's glider experiments, the Wrights built and flew successful unpowered gliders. There being no suitable power plant available to them, they built a 12-horsepower gasoline engine to power their 1903-model glider. The resulting machine founded the air age by remaining aloft for about 12 seconds on December 17, 1903, with Orville at the controls. On a later flight made the same day, the Wright airplane flew for 59 seconds and made good a distance of 852 feet.

While the Wrights had no formal engineering education, nevertheless they approached the problem of flying in a thoroughly scientific manner, making primitive wind-tunnel experiments to devise an efficient wing, and proceeding from small simple models to the full-scale machine. They introduced two new features which are still typical of modern aircraft: the use of a horizontal elevator surface for the control of the aircraft in pitch, and the control of roll by flexing the rear edge of the wings, a function that is now performed by separately movable ailerons.

When the epochal achievement at Kitty Hawk was at last appreciated and believed, there instantly appeared an impressive number of aviation pioneers. Paul Santos-Dumont, a rich Brazilian residing in France, was the first to fly in Europe; he took off in 1906. The English Channel, which had previously been crossed by François Blanchard in 1785 with the help of a hydrogen-filled balloon, was flown across by Blériot in a stick-and-wire airplane in 1909. In that same year, at an aviation meet held at Reims, the American Glenn L. Curtiss set a world's speed record of 47.8 miles per hour. The world's altitude record was also established, at 508 feet.

As aircraft improved, people flew farther, faster, higher, and for longer times. The Atlantic Ocean was first crossed by air in February, 1919, by a Naval expedition flying the Curtiss NC-4. The first nonstop crossing of the Atlantic was made the following month by Alcock and Brown, flying a Vickers-Vimy bomber. Three Douglas bombers were flown around the world in 1924. Charles Lindbergh, as everybody knows, flew nonstop from New York to Paris in 1927.

The First World War produced a tremendous improvement in the airplane. The war was commenced with stick-and-wire biplanes capable of top speeds in the general vicinity of 60 miles per hour and maximum ranges of some 200 miles. These unarmed machines were regarded as possibly having some utility for observation and artillery spotting. Before the end of the war, only some four years later, the stressed-skin *monocoque* construction had been adumbrated, if not fully invented; aerial bombing had been developed — so had the fighter aircraft intended to counter it; and the egregious Billy Mitchell had organized and commanded the first thousand-plane operation of history. At the close of World War I, it was clear to all concerned that the military airplane was here to stay, and a few brave visionaries even thought that there might be a future in the commercial carriage of passengers and freight by air.

This bright vision became less and less unreasonable as aircraft were improved in the years between the wars. In the mid-1920s the monoplane was established as the dominant type. All-metal aircraft were introduced very soon thereafter. Engine supercharging became practicable about 1930, propellers of controllable pitch a couple of years later.

It was now possible to design the prototype of the modern commercial transport, and three American aircraft builders did so. The historic Ford trimotor, still flying in South America, where good short-field performance is more important than speed and overall economy, should not be passed over without mention; nevertheless, the Boeing 247, the Douglas DC-2, and the original Lockheed Electra, appearing in that order in the years 1932 to 1934, really got the airline business off the ground. It was in the year



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1934 that the passenger-miles flown in U.S. domestic air transport began the exponential growth, doubling every two years, that they have maintained to the present day.

Air transport is now a very important component of the national and world-wide transport business. In 1955, throughout the world, there was on the average a take-off of a regularly scheduled commercial airplane every five seconds; there is at this moment a take-off every 2½ seconds. Thirty-five hundred cities are served by scheduled air transport. For all trips over 200 miles in length, the airplane is a more important vehicle than the train, the bus, the surface ship, or the passenger automobile. In the year 1956, 6.5 million landings of scheduled commercial aircraft were made on the airports of the U.S.; there were more than 300,000 landings at Chicago Midway Airport alone.

Everyone knows that this growth has not been accomplished with DC-2s or the old Electra. The conventional piston-engine transport has been vastly improved since 1934. Turbine superchargers were introduced in the late 1930s, pressurization of cabins and crew space just before World War II. These improvements, together with a general improvement in engine performance and a trend to four engines, rather than two, have brought us from the DC-2 to the DC-7, from the old Electra to the Model 1649 Constellation Starliner.

We are now on the threshold of a qualitative jump in the performance of commercial aircraft, produced by the transition to turbine engines. Commercial airliners with turbine engines, both turboprops and turbojets, are flying now, but these are the products of foreign plane makers, mostly British. American-built turbine aircraft are to make their appearance on the airlines of the world next year. The glamour items are the big turbojets — the Douglas DC-8, the Boeing 707, and the Convair 880. The work horse is likely to be the Lockhead turboprop, the new Electra. Smaller turbojets have been talked about but at this writing are not firm. It is not yet fully clear which planes will be bought by which airlines; all that is clear is that a complete cycle of re-equipment is being undertaken by the airlines of this country, and that they will come out of it with equipment at least 100 miles an hour faster than the machines which they are now flying.

However rapid the further aeronautical progress created by continuing big military budgets, this new generation of airline equipment is likely to last until perhaps 1975. The main reason for this is economic. It will be about ten years before the airlines have paid back the bankers for their investment in the new equipment.

Thus, around 1975, it will be possible for the airlines to give thought to the next step in their progress. The next step is probably the supersonic transport, flying at Mach 2 or better. (Mach 2 means twice the local speed of sound.) The main technical problem standing in the way of this development is the relatively low efficiency of engines and airframes at such speeds.

At all events, the problems of airplane design encounter a major discontinuity at about the speed of sound, or Mach 1. This is some 763 statute miles per hour at sea level, or 600 at altitude. Mach 1 at altitude is about 1000 feet per second.

The trouble with the supersonic transport is that in its present design it burns too much fuel in getting from place to place. We do not yet know how to improve the lift-to-drag ratio of the airframe, or how to push up the engine thrust produced by a given rate of fuel consumption, so as to make this airplane competitive economically. But it is almost certain that the present difficulties will be overcome with continued development.

It must be borne in mind that a faster transport aircraft, in order to be worth introduction into airline service, need not have a per-mile operating cost as low as that of the slower machine it replaces. For one thing, the traveling public has been willing to pay a premium fare for speed. In addition, the costs of the ground organization of an airline are tied to the clock; airplanes that will generate more passenger-miles per unit time incur less total cost per passenger-mile. Thus the supersonic transport, which will probably fly at least twice and possibly four times as fast as the jet planes about to be introduced, need not be as cheap to fly, per passenger-mile. However, the operating costs of designs that we can now make are out of all economic reason, and sharp improvement, attainable only by design advances, will certainly be required.

In the period between the world wars, military aircraft benefited from the design improvements that have already been mentioned, and by the time of the Second World War it was appreciated by all nations that the airplane was a new military tool of great potential value. The Italians used military aircraft in Ethiopia, both sides used them in the Spanish Civil War, the Germans conquered Poland and, a year later, the Low Countries and France in an air operation. Finally, the Nazi invasion of Crete, having been frustrated as a surface operation, was carried out successfully by air. This really marked the beginning of the



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employment of air power in something resembling the fashion which had so long been envisioned by its enthusiasts.

The German invasion of the British Isles was to have been preceded by a neutralization of the Royal Air Force and of British air defenses. This was a good idea; fortunately for the free world, it did not work. Beginning as early as 1934, the British had vigorously sought to build an adequate system of air defense; modern radar was, in a manner of speaking, invented to order. It was proposed, essentially in the form in which it was first built prior to the Battle of Britain, in response to a classified circular letter sent out by an *ad hoc* Committee for the Scientific Survey of Air Defense, headed by Sir Henry Tizard. The author of the successful response was a Scottish physicist, now Sir Robert Watson-Watt, then at the head of the Radio Department of the British National Physical Laboratory.

In addition to radar, the British first introduced on the Allied side microwave radar, airborne radar, the Pathfinder concept (in which especially trained and equipped crews and aircraft marked out targets for throngs of following bombers), radio navigation systems of great precision, the radio and radar countermeasures war, and turbojet engines. Generally speaking, the British fully appreciated the importance of electronics to war in the air some seven years before we did.

Despite this fact, we made many capital improvements in the design of the aircraft types which were subjected to the actual test of combat. The helicopter was fully realized in the early 1940s, and so was the first successful jet engine. Pressurization of high-altitude, high-performance aircraft had been pioneered in a pre-war Boeing transport, and was first used seriously in the B-29 bomber. The provision of defensive armament on bombardment aircraft and the extension of the range of escorting fighters were major preoccupations of aircraft makers during the early years of World War II. The thousand-plane raid became commonplace.

The net result was that we overwhelmed the enemy. But now that nuclear weapons have been invented, the enemy can be overwhelmed at far less cost and with far less effort than we expended in World War II. One aircraft can carry to its target a greater amount of explosive energy than the total Allied effort brought to Germany in four years of war. The new superbombs can be carried in a trunk, in the hold of an apparently harmless merchant ship, or in the cargo pit of a commercial airline transport. While we are expending considerable effort preparing to meet and counter a mass air raid on the pattern of those so effective in the Second World War, we must at the same time ask ourselves whether, given the new explosives, such a raid is the best way of causing the destruction of the chosen targets.

In the twelve years since the end of World War II, it can plausibly be argued, we have been engaged in the overdevelopment of aircraft. Certainly vast amounts of money have been spent on aeronautical research and development. These sums have purchased us a substantial return. With the development of practical jet engines, afterburning, ramjets, rocket engines, and superfuels, we are now able to build manned aircraft which go so fast that the human pilot is almost reduced to the role of a spectator. Our hottest fighter, the Lockheed F-104, is able at altitude to fly formation with an artillery shell, and at full throttle to pull away from it.

The difference between the F-104 and the artillery shell is partly that the F-104 has a man riding in it. This is a nontrivial difference. Unlike the guidance system of a missile, a man requires to be maintained in an environment something like the one he experiences in sedentary life on the surface of the earth. He needs air at not much less than half sea-level pressure, enriched by oxygen even then. He requires a temperature about 15 degrees Centigrade. He is provided with a complicated mechanism, to be actuated only in the event of impending disaster, which can save him in the event of a catastrophic occurrence such as the disintegration of his aircraft.

These airborne amenities are expensive. Their cost can be roughly evaluated by comparing our present heavy bomber, the B-52, whose take-off weight is in the neighborhood of 150 tons, with the unmanned Northrop Snark, which is designed to perform the same mission at a fraction of the B-52's gross weight.

Thus the military trend is toward unmanned missiles. Within a very few years, it is estimated that more than half the military budget for flying machines will be devoted to the development and manufacture of missiles, leaving the smaller part for conventional aircraft. Much of the missile budget will be expended in the national ballistic-missile program — the effort to develop huge rocket missiles which can span intercontinental distances by flying most of the way entirely out of the air. These ballistic missiles are, in principle, equivalent to the German V-2 of the Second World War.

As has become usual, the development of aircraft for military needs has far outstripped the development of commercial aircraft. There are already military aircraft that will fly at Mach 2.



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This suggests that even faster military airplanes be developed. Higher speeds are certainly practicable as we learn how to make engines of a higher thrust-to-weight ratio, but there is in view a limit for the speeds accessible to an airplane modeled on the 1903 Wright biplane.

Somewhere in the neighborhood of 3500 miles per hour, flight through the air with a fixed wing providing lift and an air-breathing engine providing thrust — that is, flight as we know it today — becomes impracticable. It is defeated because of the heating produced by slamming the airframe against the stationary air at such great speeds. The resulting temperature rise increases much faster than the speed; in fact, as the square of the speed. Airframe structural materials lose their strength and ultimately melt at elevated temperatures; aluminum alloys are probably unsuitable above 2000 miles per hour, and the best stainless steels are being stretched pretty hard above 3000. Even if the airframe can stand the heat, it is difficult to keep a man alive in the cockpit.

While vigorous efforts are being made to meet this difficulty head on by investigating ceramic-coated metals and other exotic airframe materials, by devising efficient skin-cooling means, and by other means, nevertheless it is still true that there is some speed at which any of these devices come to the end of their usefulness. For higher speeds, we must turn to the ballistic missile.

The ballistic missile is so named because, like an artillery shell or a stone hurled by the giant slingshot called by the Romans a *ballista*, it is propelled only over a relatively short time and distance at the beginning of its journey. For the rest of its flight, the ballistic missile is in free fall in the gravitational field of the earth. This produces an elliptical trajectory which, for any range in excess of 100 miles or so, takes the missile well out of the earth's sensible atmosphere. A minimum-energy trajectory to a target 5000 nautical miles away would, for example, involve a flight path whose highest point is some 900 nautical miles above the surface of the earth.

Thus the ballistic missile evades the aerodynamic heating problem in the most direct way imaginable — it is out of the air over most of its flight. Immediately after take-off, when the missile is gaining speed from the great rocket engines that propel it, it is moving relatively slowly in the dense air of the lower atmosphere; the time the missile spends in the atmosphere is short, the speed with which it travels is not high, and the problems of exit heating can be managed.

When it plunges back into the atmosphere at the end of its flight, however, a ballistic missile can encounter very serious heating problems. These problems are reduced to reasonable proportions by slowing the missile down at very high altitudes where the air is not dense, which can be done by adopting a configuration whose drag is high in comparison with its weight. If man-carrying ballistic missiles are ever designed and used, this is almost certainly how they will work: upon re-entry into the sensible atmosphere, the vehicle will spread out retractable wings, slow down at very high altitude, using lift to extend its range, and finally descend to a landing at a speed which is subsonic or only mildly supersonic. Under these conditions, the problem of aerodynamic heating can be dealt with in a fairly simple and straightforward fashion.

Unfortunately, the ballistic missile whose task it is to carry a bomb to a target cannot do this. To attain the desired accuracy in spite of unknown winds aloft at the target, and to diminish the risk of successful defensive interception, the warhead-carrying missile needs to come in fast; and fast, in this connection, quite literally means hot. The shock wave created in the atmosphere by a re-entering 5000-mile missile has a temperature in the tens of thousands of degrees Centigrade — several times the melting temperature of tungsten, one of the most refractory of metals.

The heat input to the re-entry body can be lowered by the control of flow conditions around it, and the heat actually communicated to the missile can be dealt with in any one of a variety of ways. Even so, the re-entry problem is one of the more difficult aspects of long-range ballistic missile development.

The regimen of flight conditions encountered at ballistic-missile re-entry speeds is an entirely new one. In the high-temperature air of the shock wave produced by the missile, molecular dissociation, ionization, and radiation are taking place. In studying these phenomena, the classical aerodynamicist must learn from the physicist who has some knowledge of spectroscopy. The familiar wind tunnel, in which air is blown past aircraft or missile models for minutes at a time while measurements are made, is being replaced by a device rather like an artillery piece, in which the steady flow past the model is over in a twentieth of a second or less. If this time seems short, we must remind ourselves that, at the speeds concerned, any longer flow duration would cause both the model and the walls of the test chamber to melt.

Equally unfamiliar to the conventional aircraft designer is the ballistic flight vehicle itself. It is no longer winged; if it has aerodynamic surfaces,



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they are vestigial. Control of the flight path is accomplished by deflection of the rocket jet. The classical problems of stability and control, which have been matters of prime importance to the aerodynamicist in the past, have now been transformed into problems of servomechanism design very closely related to the overall guidance problem.

Propulsion of a ballistic missile is accomplished by a rocket engine, since much of the propulsive effort is expended at altitudes where an air-breathing engine such as a conventional turbojet or ramjet would have no air to breathe. The merit of a rocket engine is measured in terms of what is called *specific impulse;* that is, the pounds of thrust produced per pound-per-second of fuel and oxidizer burned to produce that thrust. The specific impulse of the rocket engines we are using now is little better than that realized by the Nazis a decade and a half ago.

To improve the efficiency of a rocket motor, the exhaust velocity of the jet of hot gas which provides the rocket thrust must be increased. There are two principal ways of doing this. One is to raise the temperature of the jet; the velocity of the rocket jet rises with the square root of the temperature. The other is to populate the jet with lighter atoms or molecules, which go faster than heavier ones at any given temperature.

When the rocket's energy comes from chemical combination, or combustion, as it does in the rockets that we use now, there is a limit — and one we are approaching — to the rocket efficiency we can attain. The limit of the heat produced even by the most energetic chemical reaction is such that the reaction products cannot be raised to temperatures much beyond about 5000 degrees Fahrenheit. Further, the fact that we obtained the heat by chemical combination means that the jet of hot exhaust gases is made up of molecules resulting from that combination. These molecules are heavy in comparison with the lightest atoms, and their velocity is correspondingly lower.

A better rocket engine would be one producing a jet of hydrogen or helium at a temperature of tens of thousands of degrees. No one now knows how to build such an engine, but it is apparent from freshman physics that the energy powering such a rocket cannot be derived from chemical combustion. Rather, the working fluid comprising the rocket jet will have been heated by some other source of energy — perhaps by an electrical discharge or by a nuclear device.

Looking still farther ahead, it is possible to imagine that the rocket jet itself might consist of fully ionized light gas, perhaps hydrogen, whose positive ions and electrons have been accelerated to high speeds by electromagnetic means. There have even been suggestions of a photon engine, which is supposed to exploit the very slight recoil that occurs when light leaves its source or is reflected from a mirror. It is true that a beam of light travels at the highest speed nature seems to allow, and thus is ideal from the standpoint of exhaust-jet speed. Unfortunately, the light-pressure forces which correspond to the most brilliant light sources we presently know how to create and sustain are minuscule in comparison with the thrust a practical rocket engine needs.

With the chemical rockets that we have now, we can propel a nuclear warhead a significant part of the way around the world. We can put some pounds of instrumentation into a satellite orbit, swinging round the earth like a tiny moon; this is the purpose of the Vanguard project. To do more with chemical rockets, despite the enthusiasm of such space pioneers as Wernher von Braun, is stretching the present state of the art farther than it will reasonably go. As has been true ever since the Wright brothers originated manned flight, the capabilities of available power plants define the limits of man's ability to fly. We need a better engine if men are to leave the earth for the planets and the stars.

There is little doubt that a continuation of today's vigorous effort in aeronautical development will yield better engines. I would be willing to contend that man will make his first space flight, probably to the moon, before the end of aviation's first century.

Robert A. Millikan, one of the greatest American physicists of the last generation, began his autobiography with these words:

> When one takes a world outlook one cannot help realizing how extraordinarily different have been the life experiences of the men and women who have lived from 1868 to 1948 from those who have lived in any other period of comparable length in human history. For it has been the lot of all the generations of mankind up to the two generations which my life span has covered to leave the world at death very much the same kind of place they found it at birth. But this will not be true of those of us who come from the vintage of '68. Our ordinary life experiences bear little resemblance to those of my father and much less to those of my grandfather.

The century between Millikan's father and now is roughly the century spanned by the *Atlantic*. The social change that Millikan refers to is nowhere shown more plainly than in the development of aviation, both from the point of view of its violent novelty and from that of its total social importance. Its further development will enable man to leave the earth for the first time — probably within aviation's first century, but surely within the *Atlantic's* second.



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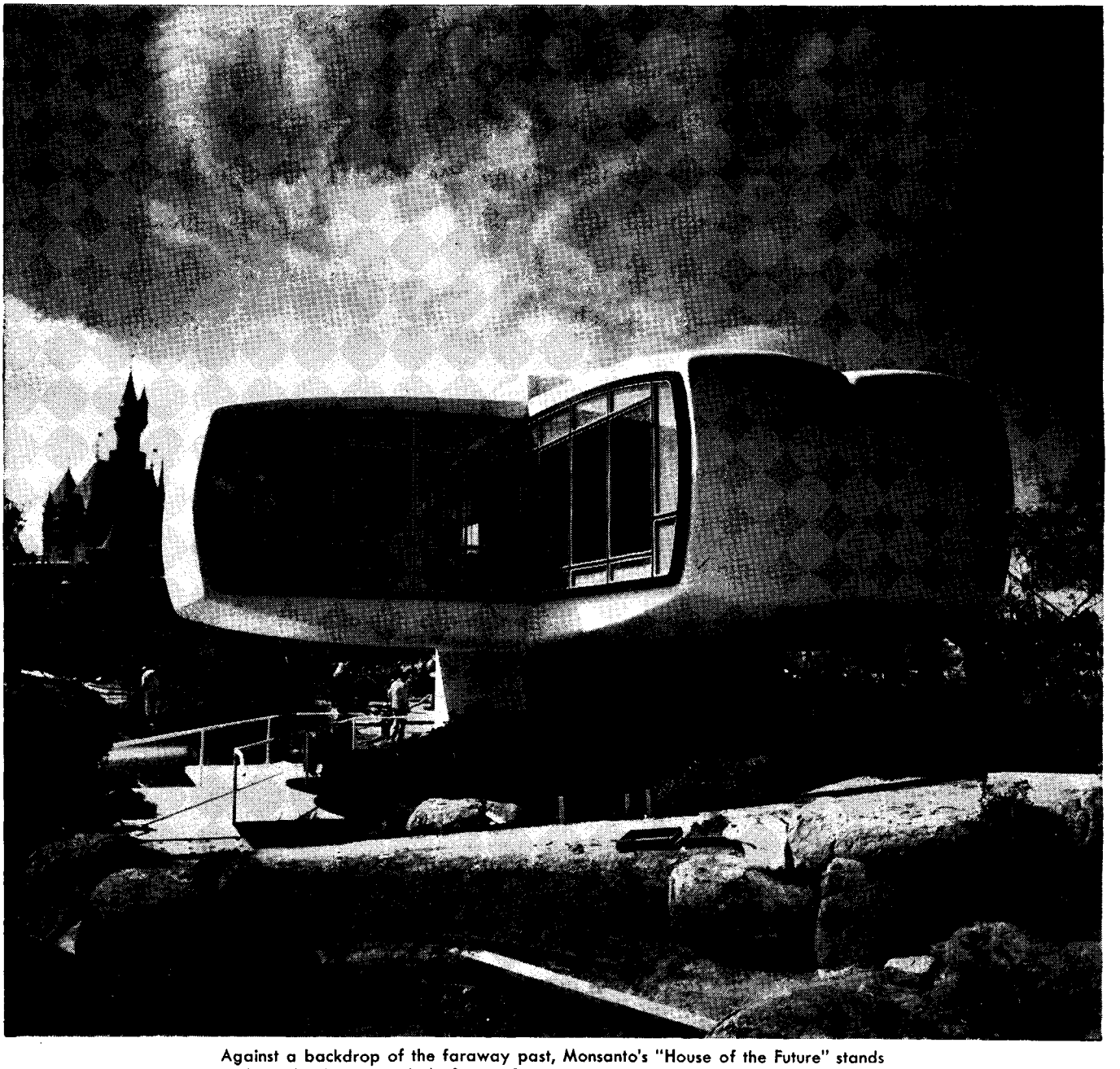

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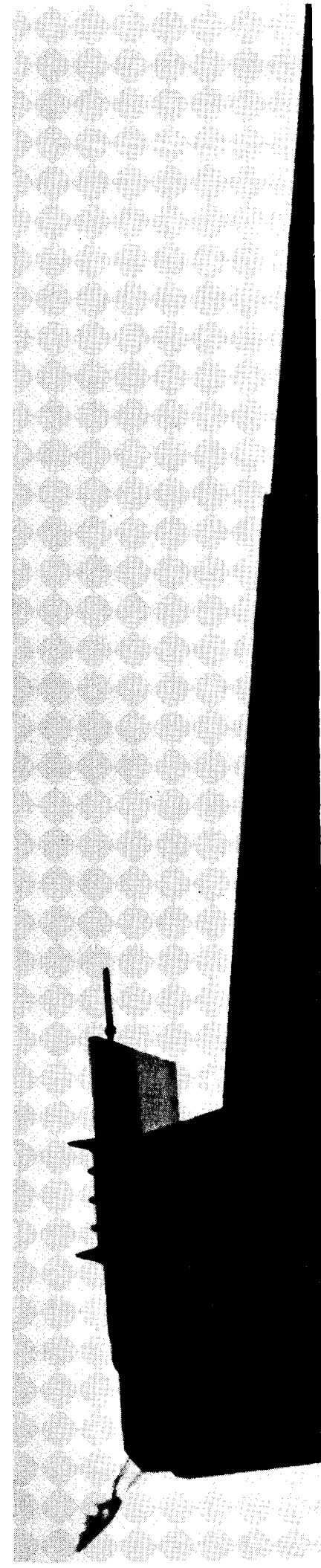

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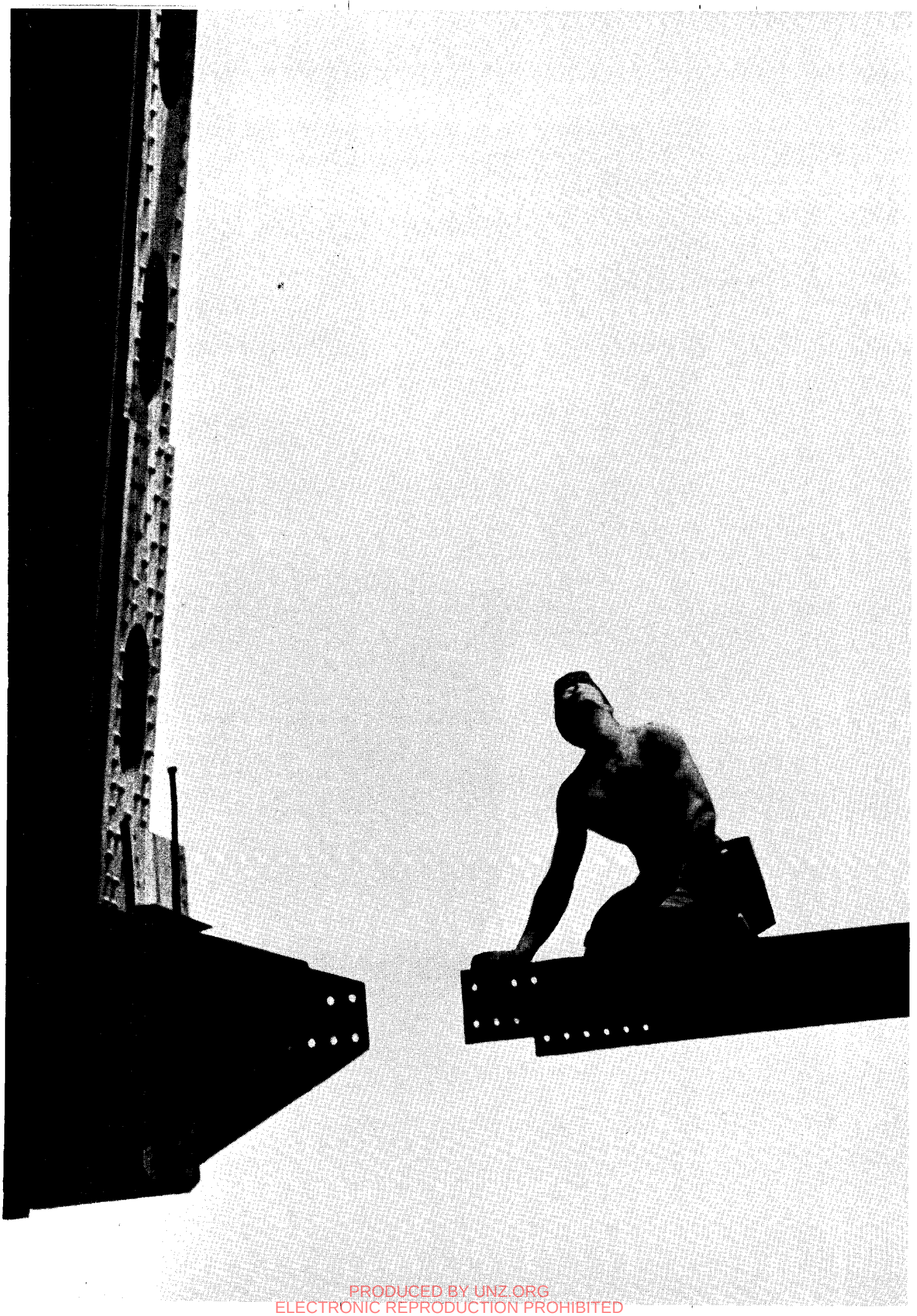

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DAVID A. SHEPARD

# THE WISE USE OF NATURAL RESOURCES

*A graduate of M.I.T. and a director of Standard Oil of New Jersey,* DAVID A. SHEPARD *was brought up in Colorado, a state aware of its natural wealth and anxious to keep it coming. He believes, as do many men in industry today, that we must conserve our natural resources.*

A COMMON characteristic in America a century ago was waste. It was not waste in a deliberate sense. It was rather the natural reaction to a land seemingly so rich in resources that it was easier for a farmer to move on from depleted acres to virgin fields (as is still sometimes done by the Brazilian coffee planter), for the logger to leave his slash piles and stumps and set his eyes on the uncut forests ahead, for the hunter to kill in wholesale numbers from apparently endless herds. I remember as a boy the family conversation about one of the country's early campaigns to reduce waste. It was early, but it did not even begin until the first decade of the present century.

Until that time, the prospect of abundance without limit and the demands of a booming country combined to press upon the industrialist, the developer, and the people generally a short-term view. Ore beds were skimmed and abandoned for richer deposits. The once sparkling waters of New England streams ran stained with the effluvia poured out by mills along their banks. The infant oil industry — the first intentional oil well was drilled in 1859 — took its place among America's industrial spendthrifts of the period.

The Pennsylvania oil fields in their early days, in fact, witnessed waste on what was then a prodigious scale. Gushers, hit by luck and with power far beyond known methods of control, sometimes sprayed millions of barrels of oil over the landscape. Natural gas flowing from the earth with the oil escaped unused into the atmosphere, or flared up from an accidental spark to incinerate wells and, sometimes, whole towns. Wooden barrels of oil, barged downstream on the crest of spring freshets, splintered and spilled as the clumsy craft piled up in jams. Volatile petroleum products evaporated from primitive storage tanks.

Beyond this physical waste was the economic. The oil business was based on the law of capture. A new discovery often touched off a frenzy of drilling as each property owner in the area strove to get as much oil as possible out of the field before his neighbor did. The result was periodic gluts of the market, with prices so depressed it was scarcely worth the oil producer's effort to move his product. Such periods were likely to be followed by other periods of zooming prices. This economic waste actually was a chief reason for John D. Rockefeller's establishment of Standard Oil. He saw that order would benefit both producer and consumer — that relief from the "boom and bust" extremes would be profitable for all concerned. Perhaps, with the ironic justice of history, the mists of emotion may sometime clear away and reveal the credit he deserves as an early and great conservator.

But the law of the land, the exuberant growth of the oil industry, and the embryonic state of technology hindered for some time the reduction of waste. The oil developments in the Southwest during the early days of the twentieth century — those fabulous finds in Oklahoma, Texas, and Louisiana — were marked by gushers, wide-open production, and the other evils of profligacy. Then discoveries were made in east Texas. The five-billion-barrel field found there in 1930 was colossal in its economic impact. The price of crude oil plummeted to ten cents a barrel, or less. With each drop in price more oil came into the market in the producers' desperate effort to get at least some slight return on their investment. The economic waste of an important natural resource on such a scale was too much for even our nation to tolerate. Some states — notably Texas — adopted new conservation laws. The Interstate Oil Compact was drawn up five years later by several oil-producing states, with the consent and concurrence of the federal government.

Today, under the terms of the Compact, a regulatory body in each of the member oil-producing states determines the maximum efficient producing rate of each well within its boundaries.



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This is an engineering standard. Then, taking into account the amount of oil required to meet market demand in a particular month, this regulatory body sets an overall producing rate for its own state. The total contemplated production is prorated among the several fields and the individual wells in those fields. The oil resources of the nation are now conserved for the utmost advantage of producer and consumer.

PHYSICAL waste of oil has been brought largely under control by technology. Today, from the very beginning of a new oil field's development, methods of controlled production, proper well spacing, the return of gas to the reservoir to maintain pressure, automatic chokes and valves, evaporation-proof tanks, and many other devices and techniques are at work to assure the maximum life to, and recovery of, oil from the field. These methods and tools are the result of research by many companies over long periods of time. The plurality of effort, which has been effective in finding the oil the nation needs, thus is also useful in developing methods to prevent its waste. Such work has made possible achievements like those in Venezuela, where the Lake Maracaibo fields are being repressurized by the injection of gas. This gas flows from the fields with oil brought to the surface and is being pumped back into the reservoir, deep in the earth's crust, by the world's largest centrifugal compressors. The compressors are housed in structures built seven miles from shore over 100 feet of water, and each one is as large as a football field. These, and other measures, mean that the total ultimate recovery from new oil fields will be much greater than had previously been possible.

A somewhat analagous but more direct approach to waste prevention is the oil industry's work in secondary recovery. This is the process of getting more oil out of the underground strata than would otherwise be possible. Today, for example, we get on the average about 30 per cent of the oil we find in the earth up to the surface where it can be put to use. Secondary recovery methods — by which much of the remaining oil is flooded out by injected water, scoured out by gases and detergents, or volatilized and driven to the well by wet or dry heat — is increasing that percentage of recovery every year. Some of the newer methods are so promising that before long we may be able to increase our recovery rate to 45 per cent. This achievement would have the practical effect of increasing the world's oil reserves by almost one half.

The story of other extractive or manufacturing industries is a similar one. The bypassed and rock-bound taconite ore lying outside the exhausted wealth of Mesabi now comes as pellets to feed the Pittsburgh steel mills. Waste water is purified. Textile fibers are made from coal, water, and air. Complex machines mine coal in greater quantities from a seam than human labor could do before. Rubber, chemicals, plastics, and other valuable materials are extracted from components of crude oil formerly burned as fuel or used even less efficiently. "Waste not, want not" has become the slogan of industry for sound business reasons.

Industry's lessons in conservation have been learned, quite understandably, for commercial reasons, but they have, to my mind, far wider significance and application than dollars and cents. We live on a planet whose population is now expanding at a rate that can, without exaggeration, be termed explosive. Experts tell us the world's present 3 billion people may increase in the next century to 7 billion. This growth is more pronounced in developed and industrialized nations; the United States, for example, has today a rate of population growth greater than India's. Obviously the calls put upon the earth's resources will be sharply increasing.

Those who work in industry are concerned not so much about the *amount* of resources available for our needs, but rather with their *wisest use*. If the promise of America's next one hundred years is to be fulfilled, society must take positive steps in the field of conservation, and in this work industry can and must collaborate.

Water is probably the most critical resource in our country today. We read with dismay of drought and flood cycles, massive in their direct and indirect destruction. Water tables are being seriously lowered in many areas, pollution and salinity are reducing the usefulness of surface and ground supplies, while on every hand there is increasing need.

Much of the demand comes from industry: our mills, factories, and processing plants account for almost 40 per cent of the country's present water consumption. The very reliance of industry upon water has led to projects which are bringing about its more effective use. Oil refineries, for example, have perfected methods of purification which return to rivers and lakes a more wholesome form of water than they originally drew out. Each year affiliates of Jersey Standard spend many millions of dollars to assure unpolluted air and water near refineries, an expense which has no immediate short-range economic justification but which we realize has important justification in the long run.

Commercial methods of distilling salt water, though expensive and difficult to maintain, have



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reached the stage where islands such as Aruba in the Netherlands Antilles or, indeed, entire countries such as Kuwait on the edge of the Persian Gulf are almost wholly supplied from sea water made fresh by distillation.

These efforts, however significant, are still — with no pun intended — a drop in the bucket. In this country at present only about three fourths of an inch of our total 30-inch average rainfall is captured and used. The possibilities of increasing our total usable water supplies are, therefore, sizable; in terms of the tremendous total precipitation in the United States each year, the recovery of only a fraction of an inch more would make an enormous difference.

As much as 65 per cent of the water lost through evaporation might be saved by the use of a chemical shield about 20 millionths of an inch thick. Experiments are now underway on a reservoir near Loveland, Colorado, where the chemical compound, hexadecanol, spread in a coating one molecule thick, is being tested to see if it will live up to its laboratory promise. Already in Australia similar coatings of this same compound have saved 200 million gallons of water over a 14-week period at the small cost of about a penny per thousand gallons.

Encouraging possibilities are inherent in our biggest source of water, those underground storage layers of sand and gravel called "aquifers." If we were to discover by geological examination how much ground water there is in these layers, how fast nature is replacing it, and how man might best proceed to recharge these vast reservoirs, we should have taken a long step forward toward the solution of the water problem.

Core holes and wells drilled to find oil tell us things we did not know about water. Three wells drilled by a Jersey Standard affiliate in the Cape Hatteras-Maryland area in 1945 were dry so far as oil was concerned, but their recordings of the geological structure of the region were of great value in coping with the problem of finding water for local use on the Eastern Shore. Experience with underground pressures and drive which are encountered in oil fields also has application to the problem of recharging aquifers.

New approaches are being devised. There is the imaginative possibility recently proposed by Dr. Vannevar Bush, who suggested the use of detergents to enable soils to absorb the water of a sudden, violent rain instead of allowing most of it to run off.

Where soil is concerned, the situation we face in the United States is also sobering. At present a good 100 million acres of cropland have been ruined for further cultivation, and this out of the approximately 500 million acres in the country originally suited for growing food. Another 100 million acres have been damaged. This ruined and damaged land is larger than the combined areas of Ohio, Indiana, Illinois, Wisconsin, and Missouri, and to it, according to the Soil Conservation Service, we are annually adding another 400,000 acres which are spoiled for cultivation. Fortunately, given the right conditions, nature can create soil, though at a far slower pace than man's ability to destroy it. The problem here is one of learning what the right conditions are and taking precautions to see that they are provided.

Those industries whose operations are directly connected with our soil — notably lumber and paper companies — have already begun large-scale conservation programs. Selective cutting of trees and scientific methods of growing timber as a crop are doing much to preserve the ground cover which builds soil and keeps its complex structure from blowing away. Other industries, such as suppliers of chemical fertilizers or producers of agricultural machinery, have acquired experience which should offer possibilities of making contributions in this area.

The commercial activities of many industries have invaded our wildlife resources. An example is the oil industry, whose rigs and exploration parties are often found in marshlands, remote coastal or offshore areas, and in wilderness regions which are the habitat of our fast-shrinking wildlife population. Happily, the industry has a good record where wildlife is concerned. Companies having acreage in the Texas coastal region, for example, which has been chosen as a winter residence by the continent's few remaining whooping cranes, confine their activities to the summer season when the birds have left for their mating grounds in Canada. Oil companies operating in or near the oystering grounds of Louisiana underwrote a seven-year scientific study of the oyster's environment and the nature of its life cycle. They did this because of self-interest, stirred by criticism and legal actions brought against them by oystermen who were convinced that the dwindling supply of shellfish was the direct result of oil operations. By exhaustive experimentation, the scientists not only proved that these charges had no basis in fact, but also isolated the minute and hitherto unknown fungus which was the real culprit. Their studies and recommendations, instigated and supported by industry, have been important in revitalizing the oyster business in Louisiana.

In Venezuela, a Jersey Standard affiliate has carefully experimented with the effect of underwater seismic explosions upon fish, so as to protect



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this valuable resource. Other affiliates regularly conduct their operations in wilderness areas with fire prevention, anti-pollution measures, and wildlife preservation as major goals.

THE problems we face in conserving natural resources are laborious and complex. The preservation of even small bits of marshlands or woods representing the last stands of irreplaceable biotic communities is interwoven with the red tape of law, conflicting local interest, the overlapping jurisdiction of governmental and private conservation bodies, and an intricate tangle of economic and social considerations. During the time spent in resolving these factors, it often happens that the area to be preserved is swallowed up. Even more formidable is the broad-scale conservation problem raised by the spread of urban belts in such places as the northeastern part of the United States. The pressures of human growth are so acute in such instances that they raise issues which would tax the wisdom of Solomon.

How and what industry might properly do in these cases must wait upon a clearer understanding of what is involved. But industry can certainly do much in helping our society reach such understanding. It can offer support to groups dedicated to studying the principles and problems of conservation. It can use its good offices to help our citizens get information. It can make available to other organizations, and coördinate within its own ranks, the daily experience it is acquiring through its operations.

Probably the most effective immediate contribution of industry could be made at the community level. Many conservation problems and opportunities are directly concerned with communities and can best be handled by them. Here industry's effort might range from participation in long-range studies and plans for community expansion to the practical steps of actually acquiring threatened areas with its own funds — or helping organizations presently set up to do this work — and turning them over as gifts to established public or private bodies. It would seem that the most practical, immediate action in the field of conservation is to preserve specific areas of land before they are overrun and lost forever.

There is no lack of things to be done by all segments of American society in conserving our natural resources. And it is high time to move forward from good starts already made. The better the understanding of all of us about wise use of resources, the better are the chances that our children and their offspring will inherit a nation in which full opportunity for the human spirit is preserved as well.

## THE DRIVE TO CREATE

BY HAROLD GERSHINOWITZ

In order to create, a man must be dissatisfied. The creative individual is a driven man. He has an inner compulsion to bring something new into the world, to make the world different. This is as true of the scientist as of the artist or poet.

The accelerated development of the sciences and the useful arts has built up a pressure to increase not only the numbers of research workers but the very pace of creativity. A flood of theories, systems, and panaceas has engulfed both the research worker and the administrator. Most of these proposals are based on unproved assumptions about the nature of the creative process. There are, however, studies now being made that give some hope of providing the quantitative data which would help answer two basic questions: How can one identify potential creativity; and what environments will stimulate the creative process? One of the most promising of the current investigations is being made by Professor Morris I. Stein of the Department of Psychology of the University of Chicago, who is studying both psychological and sociological factors in relationship to the creativity of industrial research chemists.

A different approach to the problem is that of Professor John E. Arnold of the Massachusetts Institute of Technology. He is attempting to stimulate creativity by varying both the intellectual and physical environment of his students. In some of his courses science fiction is required reading. Students are asked to design household and industrial equipment for beings with unusual numbers of fingers, arms, or legs, on worlds with gravitational fields and atmospheres very different from our own.

After the questions about identification of creative people and the proper environment for research, the problems of incentive and reward are probably the most important. Studies of these are under way with coöperative effort by universities, industry, and professional societies. In many respects incentive and reward are more difficult to analyze than the other factors involved in creativity. The basic motivation is internal, but this inner drive may be diminished or aborted if the individual does not receive what he considers adequate compensation and, more important, recognition.

*A specialist in petroleum technology, Harold Gershinowitz joined the Shell Oil Company in 1938. For a number of years he has been in charge of exploration and research, and since 1953 has been president.*



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CARLETON S. COON, *distinguished physical anthropologist and author of the highly successful* STORY OF MAN, *gives a fresh and penetrating analysis of what we know about the origins and significance of race and the human species. Dr. Coon, curator of ethnology at the Museum of the University of Pennsylvania since 1948, has written a new book,* THE SEVEN CAVES, *published early this year by Knopf.*

# WHAT IS RACE ?

by CARLETON S. COON

Now that modern advances in travel and communication have thrown the peoples of the world together, interracial problems have been forced on us all. However disguised in economic or political drapery, they are the nuclear stuff of foreign affairs. A knowledge of the facts of race has never been needed as it is today. But before we can begin to discuss race objectively or clearly, we must define it.

Race is a biological concept, as applicable to fruit flies, warblers, and raccoons as to people. Zoologists tell us that a race is simply a recognizable division of what they call a polytypic species. A species is either a single population (monotypic) or a string of related populations (polytypic). The members of both types breed only within the family, so to speak. Their failure to breed at all, or successfully, with members of other species can be due to lack of opportunity, lack of interest, or inability to produce fertile offspring.

The sister populations that make up a polytypic species usually live in adjoining and climatically varied areas, and they interbreed along the borders. If we collect valid samples of such populations and select a particularly distinctive and measurable feature, preferably one known to be genetically controlled, and then lay out the distribution frequencies of both on a single chart, we can see to what extent the two ranges overlap. If over 75 per cent but less than 100 per cent of individuals in each species differ in this feature, then the two populations are considered to be subspecies. A subspecies is exactly the same thing as a race, in man as in any other sexually reproducing animal. If we apply this test to many of the so-called races of man — Nordic, Alpine, Mediterranean — it is hard to find a valid overlap in any character. Zoologically speaking, these are not races but types.

When a population finds itself isolated from its nearest neighbors of the same species, it may develop certain peculiarities. If in the overlap test between it and another race of its parent species the ranges fail to meet, then the assumption is that a new species has been formed, provided that when its members have a chance to interbreed with those of another race of the same species they fail to do so. If, however, in a state of nature, some of them do breed successfully, then they are not separate species but very divergent races of a single oversized species.

That is exactly the situation with man. We are one enormous, varied species — *Homo sapiens* — because despite social pressure of a species-forming nature, whenever we have the chance some of us manage to interbreed with other races. This social pressure cannot be considered unnatural on the ground that it is channeled through culture, for it also exists within supposedly cultureless species of mammals and birds. Culture is not an opposite of nature but a highly organized part of it. Human races are unusually divergent because, long ago, bands of people spread to the far corners of the earth, forming there mutually isolated populations exposed to all extremes of climate and to many degrees of danger. They reacted to these influences as all animals do.

Important as culture seems in our air-conditioned present, at the time of man's initial spread it offered little immediate or local advantage over the natural equipment — fur, fangs, and claws — of competing species. It is easy to understand how men with boats, skis, and fur suits could have spread to every ice-free part of the earth, but people reached those places before any of these sporting items could have been perfected. As far back as the third glacial period, Europeans hunted mammoths in the narrow cor-



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ridor between the edges of the Scandinavian and Alpine ice sheets, and the ancestors of the American Indians had reached this continent from Asia before the end of the fourth glaciation.

As far as we know, the cultural equipment of these hardy people was limited to a few little-specialized flint tools and fire. We may presume that they lived and worked in groups. Neither what they could make with these tools nor their coöperative efforts could have been adequate to protect their bodies from the rigors of all the world's environments. Their bodies were possibly the hardiest, and certainly the most versatile, of existing complex organisms. Among some of us these qualities are still present. When Charles Darwin visited Tierra del Fuego in the *Beagle*, he found the Yaghan Indians paddling bark canoes in gale-swept waters. Each man and woman wore only a sealskin over the back, and derived a little warmth from a fire smoldering in a clay hearth in the bow of the canoe. When they neared the pebbly beach each woman jumped overboard to swim ashore. In the dry heat of the Kalihari desert, Bushmen clad only in skin breech clouts and sandals hunt antelope in sand hot enough to scorch off the animals' hoofs. A Pygmy can run through a tangled forest, a Negro walks through it, and a European cuts his way with a machete. Many a white man has frozen his thin cheeks in the Arctic where the faces of Eskimos, better supplied with blood and fat, do not suffer. Bolivian Indians can reproduce their kind and rear their children at altitudes where most white people and Negroes cannot bring children to maturity.

The relative suitability of different physiques and physiological systems to all but the most extreme environments is a matter of degree. Under proper care almost any kind of person can live almost anywhere for many years. But in the formation of races and species, in man as in other animals, natural selection rarely takes place quickly. Over many generations certain genetically controlled characteristics tend to grow scarce within a population as others gradually replace them, owing to a difference in their survival values. Evolution takes time, and racial differentiation in man is an evolutionary process.

About eight thousand years ago a few people began to upset the balance of nature in which they had, like other animals, previously lived, by domesticating certain plants and animals. They could then have more food and more children. Migrations in search of new fields and pastures carried farmers and herdsmen out of the environments to which their ancestors had, over thousands of years, become physically adjusted, and set a whole new adaptive cycle in motion. The earliest of these migrations began no more than three hundred generations ago, a short time for the re-establishment of racial equilibrium.

A second major set of migrations followed the voyages and discoveries of Columbus, da Gama, and other Europeans in the late 1400s. White people with and without Negroes invaded and settled the two Americas, South Africa, Australia, and New Zealand. A mere twenty generations separates the oldest of these settlements from the present. The racial map of the world today shows the distributions of populations representing all three periods of settlement. Some are descended from the old food-gatherers, long in equilibrium with their environments; others from the food-producers who left home after 6000 B.C.; and still others from the colonists of the last five centuries and their slaves. Each of the three presents its own biological problems.

It would be difficult to count the people, scattered over the earth, who still hunt and collect food in their ancestral territories, but they probably would not fill the city of Philadelphia. If brought together they would look even more varied than the delegates to the United Nations. In Africa only the Pygmies, Bushmen, and a few specialized Negro tribes still hunt. A Caucasoid people, the Sayyads, fish and net migratory game birds in the Lake Hamun estuary between Iran and Afghanistan. India is full of small groups of refugees from the onward march of agriculture, for India contains nearly all the world's types of environment and many nooks and crannies where simple hunters and gatherers have been able to hide for millennia. I personally have seen the Birhors, who net monkeys for their flesh in the sal forest back of Ranchi, and the Kadars, who collect honey and wild fruits in the Cardamon Hills of Kerala. Ceylon still shelters about forty unmixed and unacculturated Veddas, former lords of the island. Two Negrito tribes still remain in full vigor on the Andaman Islands, and somewhere in the shady depths of the Sumatran jungle live the Kubu and Lubu, said to be Negritos, a timid people yet unseen by anthropologists.

Little more than two centuries ago the entire continent of Australia was inhabited by many tribes and bands of hunters, who formed the largest and most isolated continuum of pre-agricultural peoples in the world and whose descendants are still our best source of evidence for the life of early man. Except for a few persons of mixed blood, Tasmania's aboriginal population, black-skinned and curly-haired, disappeared nearly a century ago through white contact.



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The whole core of the Old World land mass of Asia, Africa, and Europe is lacking in food-gatherers, so far noted only around the southern fringes. In the far north, where environmental conditions make agriculture impossible, reindeer herding, as an offshoot of cattle-and-horse raising farther south, has reduced the areas of food-gathering to a few spots where fishing is good, between Norway and Japan. Among the few groups of survivors two are Caucasoid, the Sea Lapps and the Ainu.

In the New World nearly half the land surface of the Americas was occupied by hunters and gatherers at the time of Columbus; today their descendants are still to be found among the Eskimos, in the forests of Alaska and Canada, and on reservations in Maine and the Western states. In South America scattered bands hunt along the game-poor eastern slopes of the Andes, and Chonos fish in the fjords of the South Chilean archipelago. The famed Yaghans are reduced to a few households, the Onas of the grasslands of northern Tierra del Fuego to about twenty-five persons.

When we examine the physical characteristics of these survivors from the Ice Age and from the earliest period of migration and adaptation, one basic fact is immediately clear. All the major races of the world, without exception, and according to any competent specialist's classification, are there before our eyes. This means that all the major races of man had evolved while all men were hunters. The two races which have risen to the greatest heights in creating civilization, the Caucasoid and the Mongoloid, are represented among the food-gatherers along with Negroids, Negritos, Bushmen, and Australoids. No major race evolved after the original segregation which produced these ancient subspecies.

Each of the surviving marginal populations so far studied is internally variable in many apparently non-adaptive features, such as hair form in Australia and face form among the African Pygmies. Among many higher organisms such variability is characteristic of features little exposed to environmental stress. Some anthropologists have mistaken this natural variability for mixture.

Each of the major racial groups also has features of its own which are difficult or impossible to explain on the basis of recent natural selection, but which may have to do with situations and requirements encountered in the past when the cultures of the world were even simpler than those of any food-gatherers within human memory, and possibly before the present races had evolved into the *sapiens* stage. Bushmen, Negroes, and Negritos have curving lumbar regions, tilted pelves, and a tendency to protrusion of the buttocks. Mongoloids, with flat posteriors, reach the opposite postural extreme. The lower legs and forearms of Negroes are long in proportion to thigh and upper arm lengths; Mongoloids are the opposite. Compared with other races, Negroes have heavy bones.

The skins of Negroes and Negritos are usually black, while those of Veddoids (the primitive proto-Caucasoids of India and Ceylon) who live in the same kinds of tropics are lighter or variable. Among the Bushmen, skins grow darker as one approaches the Equator from the Cape of Good Hope, and similar gradations in skin color have been observed among Mongoloids in the Old and New Worlds. The Tasmanians, who lived in a cool and cloudy island at the same distance from the Equator as New York, were as black as any inhabitant of Harlem. As their ancestors must have lived there for a very long time, we can make two observations about skin color. In some races and in certain ways black skin is a basic racial feature of great antiquity which, however and wherever it arose, is inherited in the unmixed state independently of climate. In most other races, skin color tends to be variable regionally and seasonally in concert with climatic differences.

Human skin differs from that of other animals in that it is our principal organ of heat loss, heat conservation, and hence thermal adaptation. The number of sweat glands possessed by an individual is fixed at birth, and a small man has more glands per square inch of skin than he would have had had he grown larger. Thus a Pygmy has a better cooling device than a larger man, all else equal. The amount of subcutaneous fat also has something to do with the conservation of body heat, as in the cold-living Mongoloids. In many but not all deserts, long arms and legs, long necks, and narrow bodies give hunters a maximum cooling surface area from which unimpeded breezes can absorb sweat as soon as it is secreted, and keep the body temperature within safe physiological limits. Although these apparently adaptive bodily differences occur more or less in all major races, nevertheless the skins of the major races are distinctive in ways which defy the easy explanation of climatic adaptation. These differences involve not only pigment and subcutaneous fat but also the thickness of the outer horny layer and the quantity and distribution of hair.

Human hair form is extremely variable — as variable almost as that of the cover hair of mammals of different genera. While a case can be made for the protective nature of head and beard hair in fighting, and the advantages of very tightly curled hair in keeping the head and neck cool,



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selection for these advantages could only have occurred in the distant past before men had learned how to cut and tie up their hair.

Another puzzler is the Mongoloid eye. In the structure of the Mongoloid head and face the temporal muscle is attached forward on the skull, pushing the eye socket forward and making it shallow; hence the characteristic position of the eyeball. As this is found in tropical as well as arctic Mongoloids, it cannot be explained on the basis of any modern adaptation. Mongoloids also have a high frequency of peculiar teeth, the so-called shovel-shaped incisors, rare among other peoples. No functional reason for this variation has been found. These peculiarities of eye socket and teeth must be listed with racial variations in pelvis position, limb segment proportions, bone density, skin structure, pigmentation, and hair form in a special category of profound and ancient racial differences.

To them may be added the peculiarities of the genital organs of African Bushmen. At rest the penis points forward. After a woman has reached puberty her labia minora begin to grow downward and become greatly elongated; meanwhile her buttocks become distended with massive deposits of fat. Bushmen are proud of these peculiarities and cherish them. In many animals, as indeed among flowering plants, the first organs to become differentiated in an incipient species are those of sex. On this evidence alone one could say that the Bushmen had started forth on the road to speciation through a sexual isolation mechanism.

How can we explain the fundamental differences between Mongoloids, Negroids (including Negritos), and Bushmen? Sewell Wright's principle of genetic drift seems to point out the mechanism. In very ancient times the human species consisted of a large number of small, geographically isolated populations in each of which certain mutations bore no immediate adaptive advantages or disadvantages as far as climate was concerned, but replaced the corresponding earlier forms by sheer statistical accident. Some of them, as our Bushmen evidence suggests, may have become fashionable, serving as symbols of belonging together in social systems in which coöperation was essential for group survival. Members of tight little bands grew to look as alike as peas in a pod.

In other social systems coöperation may have been less important for survival than individual enterprise. Just as some of the monkeys live in homogeneous, coöperative bands, so some of the great apes are organized into individual family bands centered on a single adult male. The same can have been true of some of our most remote ancestors. Under such conditions rivalries over women and hunting territories would have given a selective advantage to size, strength, and adrenalin. It would have been to their advantage for males to grow large and exaggeratedly mature, while the females remained small and relatively unspecialized.

Size differences between the sexes are at their maximum among the Caucasoids and Australoids and at their minimum among Mongoloids and the dwarfed races, including Bushmen and Pygmies. Among some Mongoloids as well as Caucasoids and Australoids the adult form is markedly mature, as with certain American Indians and Tibetans, whose sex differences are still relatively slight.

These basic differences in sexual differentiation and in the degrees of maturation in the adult must be based on genetic differences in endocrine balance, and be further linked to variations in temperament between both individuals and races. As the only way we can explain them is to turn to conditions existing in the most remote past, when men were beginning to acquire patterns of behavior which we call culture, these differences must be both ancient and fundamental.

Had agriculture never been invented, it is a question how many more thousands of years would have had to pass before non-contiguous races had grown into species. Speciation in man is made difficult because in human populations sex plays an unusual role. Human beings at the most primitive as well as the most advanced cultural levels copulate the year round as a social exercise that reinforces the ties needed to keep parents together long enough to teach their children how to survive in the outside world. Complicated patterns of who sleeps with whom and on what occasions further weave a tight social fabric among the most primitive bands still alive. In some societies wife-lending to strangers is a common social courtesy that helps ensure amicable intergroup relations.

Under these circumstances sexual isolation could not precede genetic isolation in man as it has done in many other animal species. Genetic isolation would have to be acquired before interracial contact could be made without mixture, and culture, even of the most primitive sort, would have rendered further biological specialization unnecessary. The answer is, therefore, that man's evolution in the direction of speciation ceased long ago; the invention of agriculture did not stop it.

Nor did the spread of agriculture terminate the process of race formation in man, which was



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carried on in a special sense. As the descendants of hunters moved about in search of fields and pastures, they underwent further biological change, but the new races into which they were transformed differed from one another less than the old races had done, for several reasons. Having occupied all the habitable space of the world except for remote islands of the Atlantic and Pacific, their hunting ancestors had already become adapted to all climates. Growing in numbers as they produced more and more food, the farmers and herdsmen overpopulated their territories and crowded each other along their frontiers, thus increasing the amount of mixture and the gene flow between populations. The new races were formed by a combination of mixture and selection.

We do not know the whole history of agriculture and animal husbandry, but enough of it has been traced for present purposes. It began about 6000 B.C. in Western Asia, and by 3000 B.C. it had begun to spread to North Africa, Europe, China, and India. The people who discovered it and first carried it were Caucasoids of one or more types familiar in Western Asia today. Wherever they went they pushed aside the native peoples, who were still hunting and gathering, and in some places fishing. Owing to the length and hardship of the route, the settlers that reached China may have been fewer than those that settled Europe, North Africa, and India.

Everywhere they went they began to mix with the aborigines. In Europe and North Africa the natives were also Caucasoids, so that no major racial change occurred. Gradually out of the mixture certain new forms emerged. Genetic traits of the old population, fitted to the local conditions by millennia of natural selection, came to the fore, and most of the people of Europe today look more like the pre-agricultural hunters and fishermen of their countries than like Western Asiatic Caucasoids. In North Africa the same thing happened.

In China the indigenous population was Mongoloid, and the Caucasoids were absorbed. In India the first farmers were the ancestors of the Dravidians, who still occupy the plains and coasts of the southern part of the peninsula. Most of the aborigines whom they met were members of an ancient Caucasoid strain, and from these people they probably derived the genetic basis for their present dark skin color, useful in their new environment, but facial features could not have changed much because the two looked alike in the first place. A later wave brought the Aryans, who were able to acquire the dark-skin genes secondhand from the Dravidians. Actually the modern Aryans of India vary tremendously in skin color, although in facial features and hair form most of them look European. Very little mixture was needed to darken their skins, because of the highly selective value of heavy pigment.

The farmers of China brought into cultivation many new plants unknown to the West and better suited than the original West Asiatic species to the summer-rain climate of Eastern and Southern Asia. Mongoloid peoples carried these plants down to Indochina, Siam, and Burma, and out into Indonesia. These all became Mongoloid countries. Except for one fact, India could have become a Mongoloid country just as easily, for Mongoloids have been moving down over the Tibetan border for thousands of years. One skull which I have seen from the Indus Valley civilization was fully Mongoloid. India did not become Mongoloid because the Mongoloids of Tibet, being adapted for cold and high altitude, are quickly bred out in the hot and steaming plain. Indochina, Siam, and Burma became and remained Mongoloid countries because the local food-gatherers were Mongoloid too. They served the invaders from the north as the Veddoids had the Dravidians in India, by giving them a genetic structure with which to survive the rigors of the new environment.

In the New World, agriculture may be just as ancient as in the Old, but its dissemination created far fewer racial problems because all the people involved were American Indians.

In Negro Africa, agriculture began to spread from a center near the mouth of the Niger River about the time of Christ, and bands and tribes of Negroes carried it to the Indian Ocean and almost to the Cape of Good Hope, arriving in South Africa at about the same time as the Dutchmen. As they passed through the Congo forest they mixed to a certain extent with the Pygmies, and farther south and east they absorbed remnants of Bushmen, as well as some of the long-faced tribes formerly known as Hamites. Without reasonable doubt these absorptions along the way helped the migrating Negroes adapt themselves to a number of new situations. For example, the Zulus, when they faced the British forces, were bigger and heavier men than their ancestors.

In every instance, when a new people brought agriculture into a region inhabited by food-gatherers, the invaders were enabled to survive and to increase in numbers only by absorbing useful genes from the natives, who had already reached a state of biological equilibrium with their surroundings. This took a long time. In every instance but one the natives were members



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of the same ancient division of mankind as the invaders, and the product was merely a genetic recombination on a single broad base. The one exception was China, where the invaders crossed a major racial frontier and became obliterated.

The third great period of migration, which began about A.D. 1500, carried Western Europeans — themselves a sorted-out recombination of several Caucasoid subraces — to the Americas, Australia, New Zealand, and South Africa, and to the islands of the Caribbean.

These Europeans who settled the new worlds in the Age of Exploration were different from their stay-at-home kinfolk in small but meaningful ways, and after reaching their destination they changed in as little time as one generation. Climate is already showing a selective effect on their descendants, as the comparative incidence of skin cancer among whites of the same stock in Texas and New England indicates.

Meanwhile, in the United States the Indian population, long adapted to local conditions, has begun to increase, as has that of the aborigines in Australia. Now that they no longer walk on the road to genetic extinction, these two peoples face the historic alternative, absorption. It is easy to ignore this now, but absorption, recombination, and selection are the very steps that followed each other in the racial history of Europe, India, and Southeast Asia, where the aborigines were few indeed compared with the unacclimated settlers. The process took a very long time, but it may also take us a long time to reach racial equilibrium. Several centuries from now, when the current excitement over integration may be looked at objectively, our descendants may wonder why so much attention was paid to the African and so little to the American Indian elements in our national gene pool.

In any discussion of racial problems a question is always raised about the relative intelligence (however this elusive characteristic may be defined) of different populations. Physical anthropologists cannot agree on this any more than psychologists can. However, we do know that wide individual differences exist in the anatomical and physiological properties of the human brain and that some of these are racial. As body form and temperament are linked, if one varies racially the other must also. But intelligence, like every other animal and human attribute, is subject to natural selection. In a situation where only the clever can survive, the dull die. In another situation, where life is easy as long as everyone is happy, and little ingenuity is required to provide food and shelter and there is no premium on outstanding leadership, the exercise of his superior imagination by an unusually clever person threatens the social equilibrium. He has become a nuisance and a laughingstock. In his case the genetic basis for his superior intelligence may turn out to be a lethal mutation.

As in every social unit a struggle is constantly going on between stability and progress, culture inhibits the evolution of high intelligence as well as promotes it. Each race has had a unique cultural history based ultimately on the series of environmental challenges it has had to meet and how it has been able to meet them, a unique sequence of events in the evolution of its own genetic range of intelligence. It would be odd if, despite these differences in experience, the genetic bases for intelligence in different races turned out to be either homogeneous or identical.

Nevertheless, in most if not all races men of superior intelligence are born from time to time. In the past it was rarely possible for many of them to meet and exchange ideas, and even in social situations where they were accepted, much of their individual brainpower was wasted. Thanks to the new techniques of transport and communication of our century, world-wide meetings of the intellectual elite of all races are becoming common. In them it has often been observed that the world's most intelligent men find it completely natural to forget about race, for the mutual stimulation of intellectual exchange creates in such a group a new level of equilibrium, in which looking alike is of no importance.

It seems safe to predict that the frequent association of the world's top minds in various disciplines can turn out to be the equivalent of that step in biological evolution for which many have been waiting: the appearance of a new and superior race based on a new adaptation, not to a special physical environment, but to the need of solving special problems which men have themselves created. As it will be drawn from many races, no master-race behavior need be feared.

The point of view expressed in this paper is a fairly new one. By studying human variations in time, space, and culture, with the tools of biologists, archaeologists, cultural anthropologists, and historians, we are gradually gaining a fresh insight into the mysteries of who and what we are, and the more we learn about man once we treat him purely as another animal, the more remarkable he becomes. Our fresh insight interprets both racism and anti-racism as basically irrational but functional natural phenomena as unschemed as hunger, the sex drive, fear, and rage. Their antithetical functions pull for and against new species formation, a question which, in the case of man, will, as with any other animal, be decided without reference to the rationalizations of either set of opponents.



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The story behind the news—told by Ernest R. Breech, Chairman of the Board, and Henry Ford II, President, Ford Motor Company

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# THE CLOCKS OF LIFE

## BY STERLING B. HENDRICKS

*How do geese know when to go South in the fall? What signals a seed to sprout when it is brought to the surface after lying for centuries underground?* DR. STERLING B. HENDRICKS *of the U.S. Department of Agriculture describes his research into the timing mechanism of plants and animals.*

ANNUAL plants bloom and set their seed before frost or else their kind perish. Fur-bearing animals start the long process of change to winter pelage when the season is hottest. Birds prepare for molting and slowly accumulate fat for migration. The young are mostly born in season favorable to survival. Plants and animals survive by adaptation to seasonal change, but since they cannot instantaneously reproduce or become dormant, they must foresee the favorable or adverse period.

What is sensed by the plants and creatures in their surroundings, and what are the biological mechanisms that enable them to respond? Can we understand why chrysanthemums bloom in the autumn? Why does wheat mature in summer? And if plants and animals generally respond to the season, what might be expected of man?

I first faced some of these questions at the end of the war in 1945, having come to their consideration both from intellectual curiosity and from a desire to achieve the practical goal of improving crop production. I really did not know at first how to satisfy either desire, but thought the aesthetic and practical objectives would be found by the same pathway, whatever it might be. My method was to search for certain controlling principles — but how? In natural science a history of observations, of classification, and of recording sometimes extends back over a century or more. Let us first turn to this record of knowledge.

The change of temperature with the season is so evident as to have diverted attention from other possible stimuli for adaptations. About forty years ago, however, when H. A. Allard and W. W. Garner, of the Department of Agriculture in Washington, were working to improve the tobacco plant, they found a plant in a Maryland tobacco field that failed to bloom with the others in the cooler days when harvest approached, but instead kept on growing to a giant size. The plant was transferred to a warm greenhouse to bloom, on the chance that it might be the forerunner of a new variety. Some seedlings from this plant were grown in a heated greenhouse during the winter. Instead of growing into giants, they bloomed when very small. Others, planted in the fields at the usual time, again grew abnormally large in the next summer.

Since the greenhouse temperature was the same as that of the field in summer, it was clear that the blooming time was not controlled by temperature. The two scientists came to the radical conclusion that it was variation in the length of the day that controlled the plant's reproductive cycle. They tested their assumption by lighting some tobacco plants at the end of the day, while others were darkened before night. The plants on short days soon bloomed, while those on long days continued to grow without blooming. Turning to other plants, the experimenters found that soybeans, poinsettias, and chrysanthemums also bloomed when the days were short. Many common grains, summer flowers, and vegetables, on the other hand, bloomed only on long days, while the flowering of still others, such as the tomato, was unaffected by day length.

Success with plants encouraged Allard and



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Garner to speculate that the time of migration of birds might also be controlled by length of day, instead of resulting from instinct or volition as some scientists believed. Tests were first made in the mid-twenties by W. Rowan, a zoologist at the University of Alberta. Juncos and crows were held in lighted cages in the open during the depth of the Canadian winter, and low-wattage lights were burned five minutes longer each day to simulate the lengthening days of spring. The birds soon began to develop sexually, and when the crows that survived misadventure were released after banding, migration was northward — to the confusion of the North Woods trappers.

Birds build their nests and lay eggs in the springtime when the days are long. Some other vertebrates, however, develop sexually on short days, as was found with field mice and is evident in the warm-blooded sheep and the cold-blooded brook trout that breed in the autumn. Many invertebrates, also, reproduce and migrate locally under control of the length of the day. Aphids, red spiders, fruit moths, shrimp, and snails are very responsive. The apple aphid is an example. Though it is born in apple trees, it lives and feeds on dockweed during the long days and bears flightless living young, but as the days shorten and the time approaches when cold will kill the adult aphids, winged migrant forms are born to return to the apple host-plant and lay dormant eggs along the branches to wait for spring. This was discovered in 1924 by S. Markovitch, an entomologist at the University of Tennessee. It was the first evidence that animals as well as plants were affected by the changing length of the day during the procession of the seasons.

WHAT is there about the length of the day that affects both plants and animals? Rowan held that the light simply disturbed the juncos and crows. Garner and Allard always spoke of the length of the day, and others, too, by natural predilection thought of the daylight period as the controlling factor. But in a twenty-four-hour period, there is both a time of light and a time of darkness, a day and a night. If the natural day is short, the night is long. The blooming of the chrysanthemum might result from the long nights instead of the short days in the autumn.

Actually, when the day and night lengths are varied in other than twenty-four-hour cycles, it is the length of the night that is found to be critical. The chrysanthemum is in fact a long-night plant instead of a short-day one, and the ability of the long night to induce flowering can be destroyed by an interruption with light. Thus, chrysanthemums or plants requiring long nights to flower will quickly come into bloom when growing on eleven-hour days and thirteen-hour nights, as in the autumn. If the plants are lighted for thirty minutes each night with ordinary incandescent lights near the middle of the night, they fail to bloom. The flowering of several hundred acres of chrysanthemums in Florida and California in winter is now controlled by stringing electric lights on poles across the fields.

This same phenomenon has been unwittingly observed by many people who have wondered why their Christmas poinsettias fail to blossom in the living room. The answer is the fact that our homes are artificially lighted in the evening, so that the plant does not receive the long, uninterrupted hours of darkness it needs for flowering.

How can plants unerringly measure the length of the night to foresee a change of season? The question was a tantalizing one to me and to Harry Borthwick, who had taken up the study of flowering in succession to Allard and Garner. Borthwick is a botanist and I am a student of the physical sciences at Beltsville. We pooled our intellectual resources some twelve years ago in an effort to find an answer.

Our approach was to go on to the next step and try to find out *how* light acts on plants. This might seem strange if the dark period or night is being measured, but darkness has only the property of duration, and the duration is ended by light. We turned our attention to how different wave lengths — or colors — of light varied in effect. A suitable prism spectrograph was built, giving a spectrum about four inches high and five feet long, from violet at one end, through indigo, blue, green, yellow, orange, and red, into the regions beyond visible light in the near infrared. The light source was a twelve-kilowatt carbon arc of the type used in motion picture projection, donated by Warner Brothers Theatres.

When artificial light was used to interrupt long nights for cockleburs, which are long-night plants like chrysanthemums, the red section of the spectrum most effectively prevented flowering. Next, plants of the opposite kind, like barley and henbane, which grow without blooming on long nights, were given long-night interruptions, using light from various sections of the spectrum. Red light again was most effective in producing a response: this time it *caused* flowering. In fact, each section of the spectrum had the same relative ability to change the flowering habits of the two types of plants, even though the changes were of opposite kinds. The conclusion was inescapable that both types perceive light and "measure time" in the same way.



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In the next stage the most pertinent experiments developed in an unexpected direction. They were largely the result of the interest of two students of seeds, Eben and Vivian Toole, whose laboratory was down the hallway from the spectrograph. The starting point was the fact that many seeds germinate only if they receive some light after being moistened. It is for this reason that packets of flower seeds often bear the caution to sprinkle the seeds on the surface of the soil and press lightly for germination.

Of greater significance is the converse fact that seeds of this type, once buried without having been exposed to light, will lie ungerminated until they are exposed. This is why farmers plowing find new weeds coming up in place of the ones destroyed. During the bombing of London in 1941 the hairy epilobium, or fireweed, and other unexpected plants came up on sites that had been covered since the great fire of London in 1666. More authentic and controlled experiments have shown that seeds can be held in soil for more than eighty years and still germinate when exposed to light.

If seeds respond to a light stimulus for germination, what color of light causes this response? Lettuce seeds were placed across the light spectrum after being moistened and held in darkness. They were exposed for only a few minutes and then returned to darkness to develop for several days before being examined for germination. Those in the red part of the spectrum were most responsive, and the relative action of the several colors in germination was exactly the same as in flowering control. One paused to think, for no obvious biological similitude exists between flowering and seed germination. Then, too, the flowering response is a periodic one resulting from the succession of days and nights, while the seeds require only a single brief exposure to light.

A most interesting phenomenon occurred among the seeds exposed to infrared light. When the lettuce seeds were placed across the spectrum, others were held in darkness as controls, and about 20 per cent of these germinated. In other words, one seed out of five normally germinated without any light. As we have seen, among those seeds exposed, the ones in the red part of the spectrum were helped in germinating. It was apparent, however, that those at the infrared end of the spectrum, just at the limit of visible light, actually germinated *less* than those that received no light at all. It seemed that this infrared radiation must act in just the opposite way to the red part of the spectrum.

To explore this finding, lettuce seeds accordingly were first exposed to a little red light to promote germination and immediately afterward to infrared radiation. The suppression of the first response was dramatic. In fact, if lettuce seeds are repeatedly exposed to red and infrared radiation in succession, they germinate if the last exposure is to red, and remain dormant if it is infrared. In nature, this type of reversal is not evident, since the plant receives infrared only as a part of daylight, when red light is also present and is dominant.

If germination control was reversible to light of different parts of the spectrum, and if the response that produces germination was the same as that in flowering control, was not flowering control also reversible? The possibility had never been suspected. The prejudice had been to regard darkness as nothing. When, however, the cocklebur plants which had been stopped from flowering by exposure to red light were exposed to infrared, they were induced to flower. The response could be repeatedly reversed in the same way as for seed germination. The reaction to light that controls such processes as flowering in plants is, then, reversible.

With this background, the flowering plants and the germinating seed were studied further to find which of the two pigment forms — the one responding to the red part of the spectrum or the other that responds to infrared — triggers biological activity. The answer found from studies of lettuce seed germination was that biological activity is connected with the infrared form. The seed lying dormant in the ground for a hundred years is dormant because shortly after burial the pigment permitting growth changed from the form that can produce biological action to the more stable but ineffective red-absorbing form. Only when the seed is exposed to red light can the pigment change back to the other, biologically active form.

Plants use the reversible reaction to light for purposes other than anticipating the change of season. If grass is covered with a board the leaves turn yellow and the stems lengthen greatly in the course of several days. The stems of seedlings from deeply planted corn or wheat lengthen in this way until the surface is reached, where normal growth starts. When seedlings are grown in darkness and then exposed across the spectrum, lengthening is suppressed by the various colors in the same relative way as is flowering. Again, the initial controls must be the same.

Another example is shown by trees. Trees grow rapidly during the early summer, but when the nights lengthen in July and August, the buds become dormant in preparation for the winter.



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When the nights are even longer, a layer of cells grows across the petiole of the leaf and cuts it off the tree. This is autumn. This whole process is controlled in part by the reversible light reaction, and in part by the fall in temperature.

WHAT about the animal's sense of time and season? Consider the weasel, the snowshoe rabbit, and the ptarmigan. Each has a protective white coat in the winter which we might reasonably think is induced by the cold that brings the snow. When the skin is examined in midsummer, however, the hair or feather follicles are found to be already losing the dark dye of the summer coat, and fat is accumulating even though the days are still warm. By early August the change to the winter coat is well under way and the summer coat starts to drop. The effect of alternating periods of light and darkness on such changes is shown by experiment. When the snowshoe rabbits are blindfolded for part of the day, simulating the change of season, the shift to the white winter fur is hastened. The ptarmigan, lighted in the winter, changes back to the speckled feathers of summer and lays her eggs in the snow. The winter coat of the weasel in the north is the white of the ermine. Further to the south, where little snow falls and the nights are shorter than in the north, the guard hairs of the fur change but the color remains brown. The weasel in a sense both anticipates the winter and measures the latitude, with its implications about snowfall, by the length of the night.

Sheep sent out from England to settlers in Australia and New Zealand were confused by crossing the equator to the south temperate zone with its reversed seasons, and bred again six months after breeding in England. They were then on schedule with the seasons and resumed yearly lambing.

Sheep, with a five months period of gestation, are long-night animals for coming into heat. As a result, they conceive in autumn and bear their young in spring, which gives the lambs time to develop before the next winter. Horses of the Scottish Isles, on the other hand, are short-night animals, breeding in the spring. Since their gestation period is eleven months, their foals are born the following spring.

Borthwick and I, knowing the superficial similarity of response of plants and animals, thought that they might be alike in their way of measuring time. We hesitated, though, to try sheep or birds in the spectrum experiments because of the difficulties of handling them. We turned instead to snails, which are seasonally responsive in egg-laying and easy to deal with. Charles Jenner and Oscar Paris, zoologists of the University of North Carolina, who were studying egg-laying of snails induced by short nights, arranged to supply a number for testing in the spectrum. Only a few snails survived, and these responded poorly without any evident similarity to plants. For the time being we face a blank wall in attempting to correlate the seasonal responses of plants and animals.

We know that seasonal changes of animals are chiefly associated with reproduction, or change of form as in insects. In vertebrates, these changes are controlled by the hormonal secretions of the front lobe of the pituitary body and by the action on the pituitary of hormones from the reproductive system. The part of the central nervous system that is called the hypothalamus, closely associated with the pituitary both by tissue connection and through blood vessels, is also part of the controlling system. In insects, a group of large cells in the brain secrete hormones that act on a gland around the thorax to release hormones that control change of form.

All hormonal controls are complex. They slowly go through a rhythmic cycle similar to sleeping and waking. The rhythms are usually repeated about every twenty-four hours and can be shifted by changing the timing of day and night, but the shift often requires a number of days for its accomplishment. This very resistance to change indicates the importance of the rhythm for warm-blooded animals, while the eventual response shows how the environment is ultimately controlling. If the day and night lengths match the hormonal rhythm, the animal responds in one way, but if the light cycle and the hormonal cycle conflict, a modification of either the response or the rhythm must occur.

The sensing of light in the environment is in the region of the eye, as was shown by blindfolding the rabbit, but whether vision is involved, or the eye is merely a window to the optic nerve and the hypothalamus as part of the central nervous system, is still very uncertain. The most revealing experiments were done on ducks that developed sexually in response to light after their eyes were removed. The best evidence is that light acts as a stimulus to the hypothalamus.

Perhaps the parts of the timepiece are clearer to us than is the running of the whole, but this partial understanding is all that we have at the present time. Egg-laying of the chicken illustrates the total operation. My information comes from our colleague, Richard Fraps, who has been studying egg release for many years.

The commonplace but startling fact is that chickens lay eggs during the light period of the


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day, usually between 8 A.M. and 4 P.M. Eggs are laid one a day in sequences of two or more consecutive days. Typically, the first egg of a sequence is laid early in the day, the eggs that follow on successive days somewhat later, until on the day that an egg is laid in the late afternoon the sequence is complete and no egg at all is laid on the following day. On the second day following, a new sequence is initiated. The four-to-eight-hour period in which eggs are laid can be shifted to any time of the twenty-four-hour day by shifting the time of the light and dark periods, though the response is not immediate.

The timing is determined by a complicated sequence of events in the hen. Egg-laying is stimulated by the onset of darkness about thirty-six hours before the first egg appears. The absence of light apparently causes the hypothalamus to act on the front lobe of the pituitary so that this gland some eight hours later releases an ovulation-inducing hormone, which causes the expulsion of a yolk from the follicle of the hen's ovary. This yolk takes about twenty-four hours to develop into an egg ready to be laid.

While the egg is developing, the timing mechanism is being reset. This is done by hormones from the ovary acting on the hypothalamus and the pituitary. It takes a little more than twenty-four hours to reset the release of the ovulation-inducing hormone. As a consequence, the relaying of each following egg occurs a little later in the day. As the action of the ovary on the pituitary gets more and more out of phase with the rhythm of the hypothalamus, finally an egg is laid so far out of phase with the cyclic sensitivity of the hypothalamus that the whole process stops for a day, and there is no egg. This timing scheme is the seasonal controlling system for birds and other warm-blooded vertebrates.

Careful breeding of poultry, incidentally, has made it possible to bring the action of the ovary on the pituitary so nearly in phase with the rhythm of the hypothalamus that certain hens will lay eggs for as many as a hundred successive days without a break. In contrast, an ordinary hen will take a day off after every two or three eggs.

And so we come to man. He is only mildly seasonal, although poets sing of the springtime and interesting stories have been told about the Eskimos. I know of only one certain seasonal response, the cyclic variation in the ratio of male to female births. The average percentage of male births in the United States is 51.36. The monthly variation is from 51.20 to 51.50, which is a tremendous amount for the 61 million births in the thirty-year period studied. The maximum is in June, with a subsidiary maximum in January and a minimum in February.

If a response to light or some other feature of the environment is to be seasonal, it must first result in a daily cyclical change of the animal. If the daily change is either very weak or very strong, the seasonal change might be obscure or absent. Man is diurnal in this sense rather than seasonal. This is most evident by his sleeping and waking, but it is also apparent in other cyclic changes, particularly those in response to stress. One of these is the level in the blood stream of the compounds related to cortisone that arise from the interaction of hormones from the pituitary and the cortex of the adrenal gland. The temperature of the body also has a slight daily variation.

Perhaps of greater significance is the daily variation in the frequency of cell division in the epithelial and muscular tissues. The numbers of dividing cells in the skin and in muscle are greatest in the middle of the night, and few can be found in the afternoon. The hypothalamus is rhythmically changing and shifts with the day and night, as is seen when one travels quickly by air to the Orient, but the seasonal control is absent.

Many experiments are in progress on plants and animals, either to explore more deeply into causes for seasonal change, or to make any of the myriad possible applications to growing of things. I am trying to isolate the pigment in plants that absorbs light in the reversible reaction controlling flowering and seed germination, and to find the next reaction that it controls. Harry Borthwick is trying to understand more fully the responses of a large number of varieties of barley, wheat, and chrysanthemum to the length of the night and to light. Others, in Australia, are finding how cattle shed their coats to adapt to warm seasons. In India rice is under observation, in Japan germination of forest tree seeds and the life cycle of silkworms, in England the dormancy of tree buds, the reproduction of sheep, and the change in form of red spider mites, in Hawaii the prevention of flowering of sugar cane, in Russia the growth of cotton. France, Portugal, Belgium, Holland, Germany, Italy, and Rumania — each has some contributors to a fuller understanding of these plant and animal responses.

The day, the night, the seasons, higher animals, insects, man, and plants are bound together in a most intricate way, but through this intricacy runs the simple thread that we have followed. Remember this when you next buy an unseasonal bouquet, or when you swat the bothersome mosquito, or watch the southward flight of geese, or carve the Thanksgiving turkey, or relish the spring lamb.



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# How General Electric tries to do its part

A SHORTAGE of educated people may, in the long run, be the greatest limit to America's capacity to provide the good things everyone wants.

Meeting such a challenge depends primarily on each individual's plans for his self-development, with the encouragement of parents and with the effectiveness of America's educational systems.

But businesses, too, are developing increasingly effective ways to help people further their education. At General Electric, for example, one person out of every eight is taking additional education or training. On these pages are some of the ways the company is trying to help young people set high educational goals—and to encourage all employees to achieve their full capabilities with increased personal satisfaction.

Education must be a lifelong pursuit for every citizen. The more individuals recognize this, the more they will seek to develop themselves to take advantage of America's expanding opportunities.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

## WORKING WITH SCHOOLS TO

**Awakening students to future opportunities.** General Electric's science show, "House of Magic," is one of many ways we try to stimulate secondary-school students to tackle their studies with enthusiasm and appreciation. Each year 700,000 young people see the show.

## PROVIDING OPPORTUNITIES FOR MEN AND WOMEN AT GENERAL ELECTRIC TO DEVELOP TO

**A chance to acquire new skills.** General Electric conducts 1,000 courses in factory skills to train or retrain employees. George Du Pont (above), a welder with 14 years' experience, recently completed 3 weeks of full-time schooling in new techniques.

**Encouragement to continue schooling.** Plans for college-level studies are worked out with hundreds of General Electric people. Paul Gagnon (above) recently graduated as an engineer from the U. of New Hampshire as a result of a 6-year work-and-study program.

**Expanding opportunities for technicians.** General Electric offers people with aptitude (but not necessarily a college degree) a chance for responsibility as technicians. For example, Winifred Balz (above) is taking advantage of our Technician Program.

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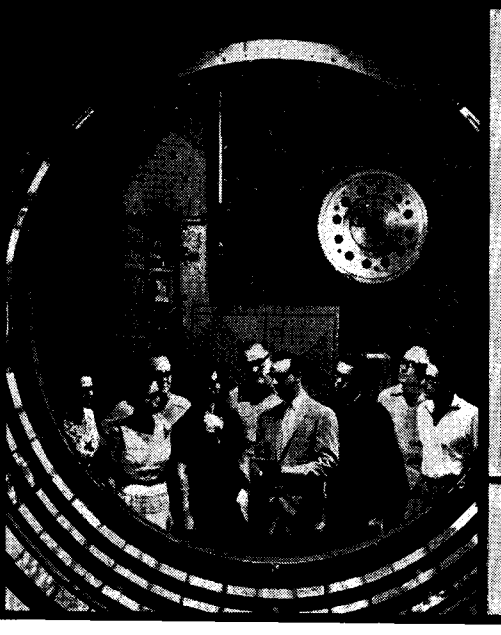
# in helping people further their education

## ENCOURAGE YOUNG PEOPLE TO FURTHER THEIR STUDIES

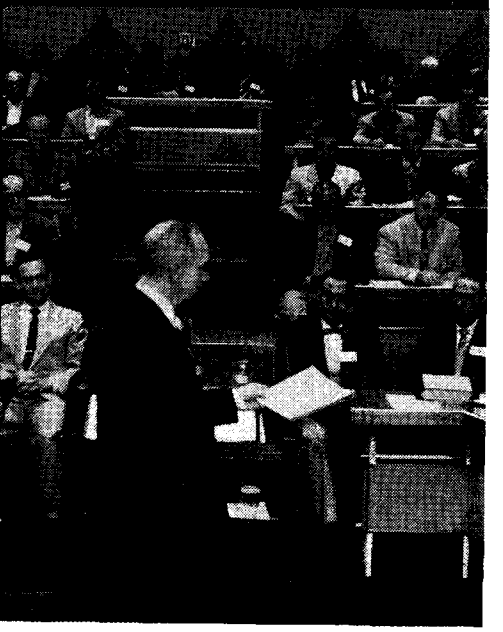


**Providing career-guidance materials.** General Electric furnishes teachers, at their request, with materials that point up to young people the value of further studies. Above, a teacher counsels students with a G-E guidance booklet, "Why Study English?"

**Helping teachers to be even more effective.** Through G.E.'s summer fellowships, over 1,900 math and science teachers have had graduate study and seen firsthand how their subjects are put to use in business. Above, teachers see the "insides" of giant turbines.

**Financial help to colleges.** To help employees "pay back" their colleges for the education from which they and the company are benefiting, the General Electric Educational and Charitable Fund matches alumni support payments made by employees.

## THEIR FULL ABILITY



**Programs for college graduates.** Education doesn't stop with the end of college. Robert Erskine (Minnesota, '56) gains more knowledge and experience in the G-E Manufacturing Training Program—one of 11 professional programs offered to recent graduates.

**Advanced professional development.** In advanced courses at General Electric, qualified men and women can study in many different fields under the leadership of experts. Above, Professor C. R. Christensen of Harvard leads a seminar in Marketing.

**Study in the work of managing.** Education continues for people in management, too. Above is a seminar at General Electric's Management Research & Development Institute. The work of managing is also being studied by 6,000 people at plant locations.

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# TRAFFIC CONTROL

## IN CROWDED SKIES

### by EDWARD P. CURTIS

*In February of this year President Eisenhower called* EDWARD P. CURTIS, *vice president of Eastman Kodak Company, to be his special assistant for aviation facilities planning. "Modern aircraft," wrote the President to Mr. Curtis, "can be operated in the numbers required by the national defense and the civilian economy only if airports, navigation aids, air traffic control devices and communications systems are suitable for their needs. . . . To delay the formulation of a comprehensive plan is to invite further congestion of the airspace, needless hazard, economic loss, inconvenience to users, and possible impairment of the national security."*

*During World War I, Mr. Curtis was a combat pilot and a member of General William Mitchell's staff, and in World War II, as a major general, was General Spaatz's Chief of Staff of the Strategic Air Force in Europe. Last May Mr. Curtis completed his report to the President, and here is what he recommends.*

FACING THE FACTS

The airplane has become the prime mover of our population in its circulation over distances beyond 200 miles. There has been no serious lack of foresight in our seizing upon the opportunities presented by the air. We have developed 158,000 miles of airways over continental United States, and our aircraft population has grown from 29,000 in 1936 to 90,000 today. By 1975 we expect the U.S. aircraft population to increase to 125,000.

As these aircraft become more versatile, productive, and dependable, they are flown more each year. While in 1936 there were 5 million take-offs and landings at the nation's airports, there are now 65 million, and 115 million are forecast for 1975.

During peak hours on busy days in 1956 there were 270 aircraft simultaneously airborne in the Los Angeles area (which generates the largest volume of general aviation in the world). It is estimated that by 1975 this number will have grown to 730.

At the present time, our aviation facilities are hard pressed to manage, within the bounds of prudence, even the fair-weather flow of air traffic. They are wholly incapable of meeting more than a fraction of the far heavier demands upon our airspace which the national strategy and the market are certain to impose by 1975.

Actually there is no shortage of airspace for any demand that can now be foreseen. Our problem is an obsolescent traffic control system which was never designed to cope with the complex mixture of civil and military traffic that now fills the air. So intense is the pressure, especially around the major metropolitan centers, that a drastic rationing of airspace will soon be inescapable unless we install a more efficient system of traffic control.

Today, even in clear weather, when traffic congestion reaches the magnitude indicated by our statistics or when the speed of converging aircraft reaches that of a 45-caliber bullet, complete reliance on a pilot's ability to see and avoid a collision is questionable. A safe system now and in the future requires continuous traffic control regardless of visibility condition.



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By 1975 the airport capacity of the country must be doubled, and the number of aircraft under traffic control will increase by ten times.

ALLOCATION OF AIR LANES

1. We are convinced that aircraft depending solely on pilot vision and alertness to avoid collision cannot safely share the same segments of airspace as those aircraft which are kept separate by air traffic control. The plan envisions, therefore, division of the airspace into zones.

2. First, all airspace above a designated altitude will be set aside for controlled separation at all times, because visibility and speeds at higher altitudes are such as to make "see-and-be-seen" flight unsafe.

3. Below this upper zone, a further division of airspace will be made. Funnels and cylinders of airspace are reserved for controlled separation of aircraft traveling from the upper zone to airports. Separate traffic patterns, final approach lanes, and separate runways will, whenever practical, be provided for high and low performance aircraft either at the same airport or adjacent to it. Highways of controlled airspace connecting the funnels and cylinders are reserved for controlled separation of low-flying traffic.

4. Airspace outside the highways, funnels, and cylinders is reserved for aircraft capable of visual collision avoidance.

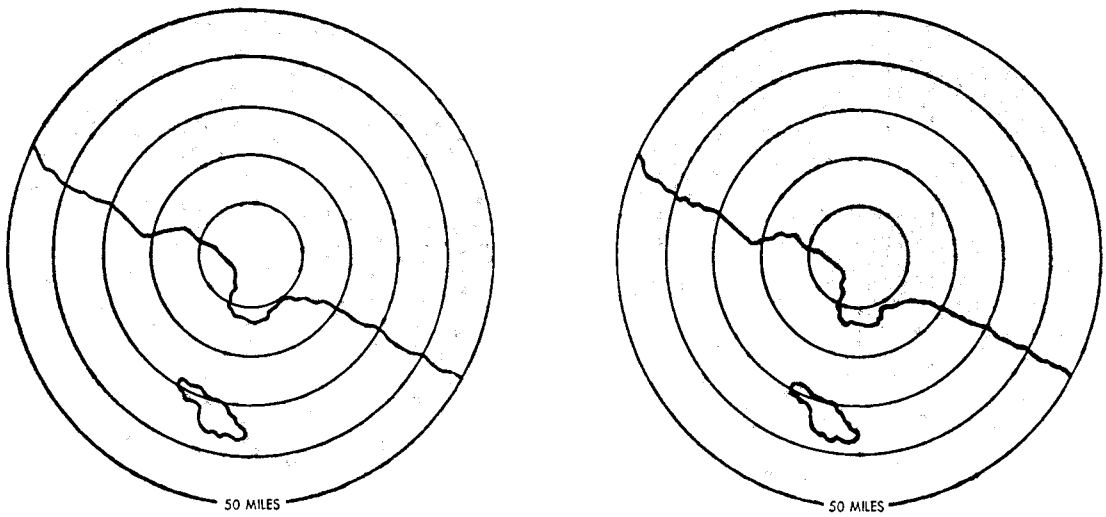
5. For flight in see-and-be-seen airspace, aircraft must meet accepted minimum cockpit visibility requirements. They must be flown below a designated airspeed and carry a barometric altimeter to determine altitude boundaries of controlled airspace. It may also be necessary for see-and-be-seen aircraft to carry a simple electronic device to detect the edges of controlled airspace.

6. The paths required by the users vary with type of aircraft, length of flight, and weather and wind conditions. For short-distance flights between population centers, fixed paths will be used.

7. Transcontinental flights, on the other hand, will have flexible paths to take advantage of the most favorable flying conditions. These flights commonly take place at high altitudes where they do not interfere with traffic on the fixed paths.

8. Direct flights between minor population centers are a small percentage of the total traffic and tend to spread out over the whole country. Thus, in any particular area, the density of this type of traffic will be very low, and separation can be provided without undue complication.

9. For flights inbound into terminal areas, descending paths that converge on the airport are required. Also, inbound aircraft must maneuver so that they will be lined up and ready for the final approach at the correct altitude and airspeed. The path an aircraft follows during this maneuvering process will combine descent with horizontal path stretching in such a way that aircraft reach their destination in a sequence with other aircraft landing at the same terminal. Ascending paths will be provided for outbound flights.




*Simulated radar display showing distribution of airborne aircraft in the Los Angeles area. The circle on the left shows the peak load on a busy day in 1956 — about 270 aircraft. The circle on the right shows estimated load forecast for 1975 — about 730 aircraft.*



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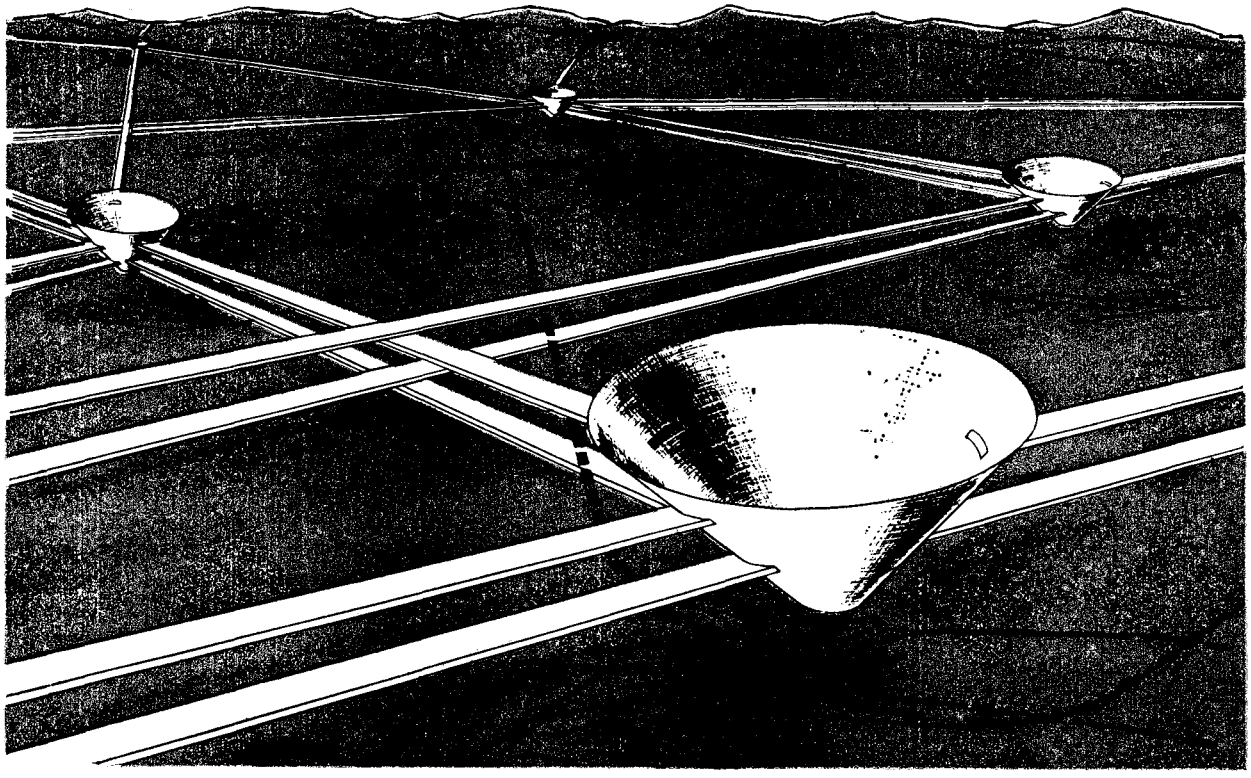

*Division of airspace below the upper, all-weather control zone. Cones of controlled airspace funnel traffic between the upper controlled zone and airports on the ground. Slant airways (not shown) lead from the bottom of these cones down to the airport surface. Ribbons of controlled airspace link the cones with each other. Dashed line shows separate, nonconflicting path of see-and-be-seen aircraft.*

TRAFFIC CONTROL

Control of air traffic will be carried out by a central ground authority by continuous prearrangement of airspace reservation for each aircraft, as contrasted to free flow of traffic with the control system intervening occasionally to resolve potential conflicts. The airspace will be divided up further into blocks of airspace defined electronically by a navigation system, and used as a basis of defining airspace reservation.

The air situation will be determined by the air traffic control system by two independent methods: reporting of position by the aircraft, and a three-dimensional ground surveillance system. The position data from these two sources will be correlated by air traffic controllers to determine flight progress and to assign clear airspace in the process of air traffic control.

Communication will be essentially automatic between all elements of the system, thus eliminating the delays encountered today because of the delays in voice communication. Voice communication, however, will remain the basic emergency means of communication throughout the system in case of equipment failure, and for those operators who do not, because of the expense involved, install coöperating automatic communication equipment.

Control will be decentralized, with each controller having a display of the airspace under his jurisdiction tailored to fit the geometry of his airspace. Data will be concentrated and organized to suit the functions of each controller. The human controller should — and can — retain his vital role as the decision-making element of the system.

But the processing, storage, communication, and display of data used to make the decisions will be thoroughly mechanized. Additionally, automatic devices will be used to carry out calculations to facilitate scheduling and to expedite the flow of traffic.



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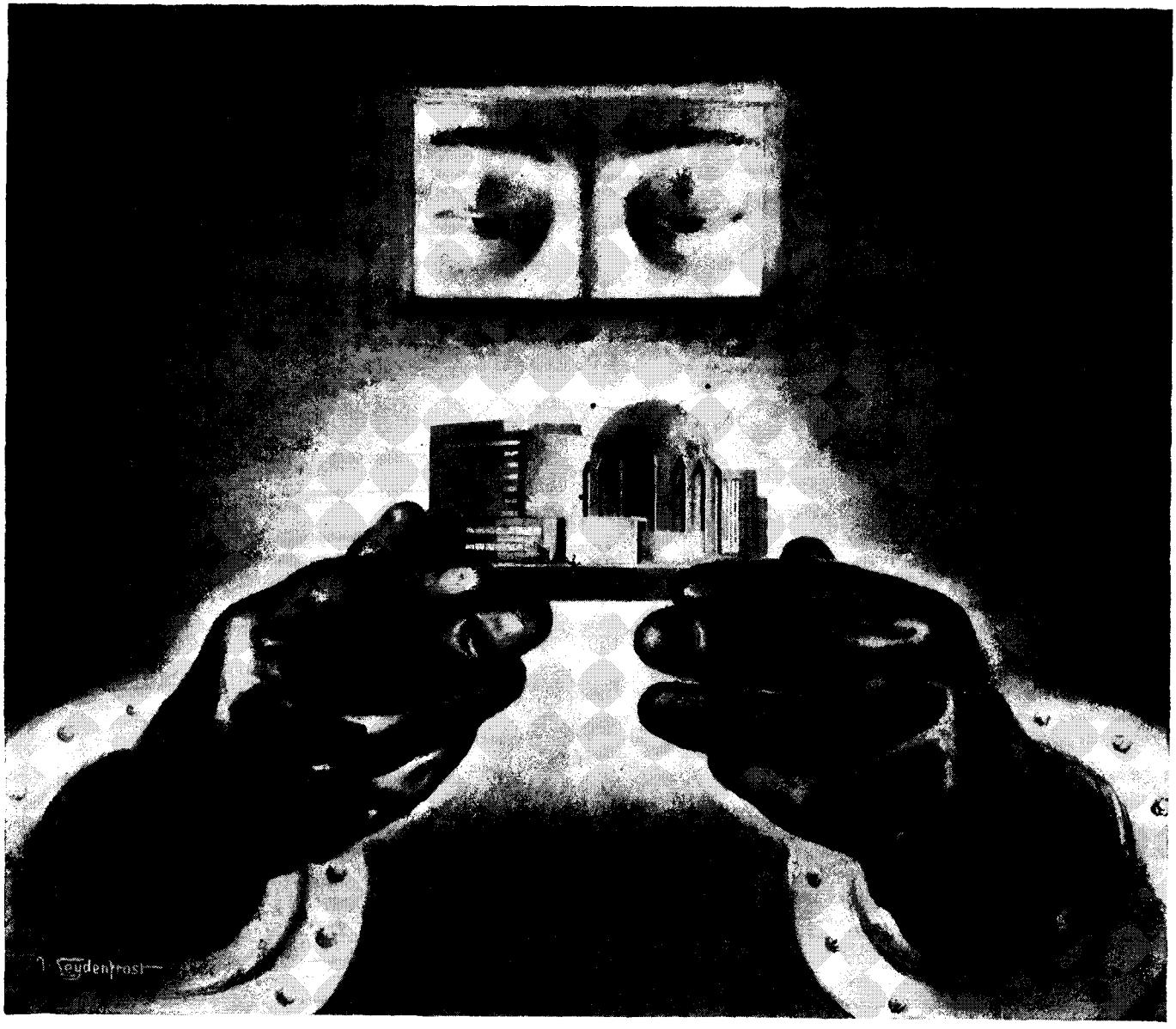

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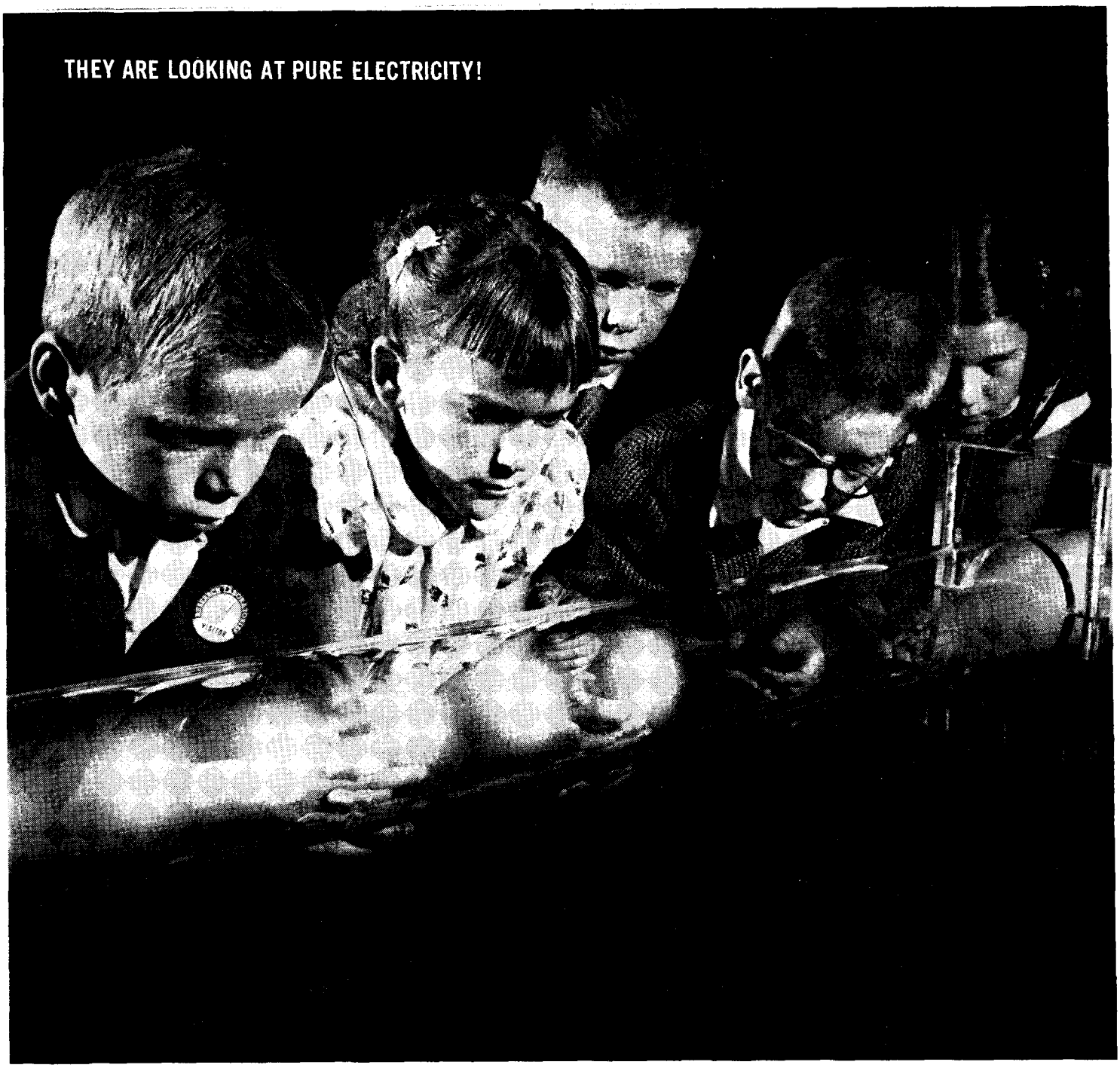


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*The growing need for research workers and scientists has opened new doors for women.* HELEN HILL MILLER, *who for many years was Washington correspondent for the London* Economist, *describes some of the work being done in science both by single women and by those who successfully combine marriage and a career.*

# SCIENCE: CAREERS FOR WOMEN

by HELEN HILL MILLER

ONLY yesterday, women who entered such fields as science, engineering, medicine, were looked on as square pegs trying to force themselves into round holes where they weren't wanted and didn't fit. Not many married women worked outside their homes in any occupation, and teaching and nursing were regarded as the suitable means of self-support by spinsters.

But yesterday is over. Today, according to recent surveys, every woman can expect to work outside her home for from eighteen to twenty-five years of her life. Since 1950, more than half of the newcomers to the nation's work force have been women. Sizable numbers and growing proportions are engaged in jobs that used to be regarded as exceptional. And manpower shortages have been tight enough for their arrival to be greeted with enthusiasm; the American population is doubling every fifty years, the need for skilled workers is doubling every twenty years, and the need for highly trained scientists and engineers is doubling every ten years.

Now about 5 per cent of the doctors of the country are women; about 10 per cent of the chemists; about a quarter of the biologists. Some of these are the knowledgeable, careful assistants — the Marthas of the laboratory — who free top men for work on the frontiers of science, but by no means all. Dr. Gerty Cori, biochemist at Washington University in St. Louis, is a Nobel Prize winner; she is also one of the 571 members of the exclusive National Academy of Sciences, which since 1925 has six times extended an invitation to a woman, including this year's admission of the University of California botanist, Katherine Esau. The two oldest scientific clubs in the country, the American Philosophical Society formed by Benjamin Franklin's Philadelphia coterie in 1743 and the American Academy of Arts and Sciences founded in Boston in 1780, now both have women members. This year's president of the Royal Astronomical Society of Canada is Helen Sawyer Hogg, trained at Mount Holyoke and Radcliffe, and winner of the Annie Jump Cannon medal of the American Astronomical Society; Wellesley's professor of botany, Harriet Creighton, was the 1956 president of the Botanical Society of America; the Argonne Laboratory's Hoylande Young is head of the Chicago Section of the American Chemical Society. Since such posts are valuable rungs on the ladder of professional advancement, the holding of them represents capacity competitive with the best in the field.

All this has happened very fast. When the *Atlantic* was started, women scientists were next to unknown. True, two years after the American Association for the Advancement of Science was founded in 1848, it recognized two women: Maria Mitchell, who started as assistant to her astronomer father on Nantucket Island but rode into independent status on the tail of a comet she discovered in 1847, and Margaretta Morris of Germantown, whose paper, "Remarks on the 17 Year Locust," was actually read by Professor Louis



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Agassiz. In 1850, the Woman's Medical College of Pennsylvania opened what is today the only non-coeducational medical school. In 1857, Elizabeth Blackwell, the first woman to earn an M.D. in the United States, recruited an all-woman staff for her newly founded New York Hospital for Women's Diseases. Shortly thereafter the Boston Hospital for Women and Children opened the first training school for registered nurses. Its present director, Alice Lowell, is one of the first of seven generations of the Lowell family to specialize in medicine. In 1884, Cornell's Sibley College of Engineering admitted its first woman student. But such "firsts" were few and far between.

Much of the time and energy of women who entered the scientific professions in the nineteenth century was spent in either contriving to take barriers gracefully or crashing into them with results demolishing sometimes the woman, sometimes the barrier. Eminent women now in retirement well remember where fences were located and where they were coming down when they entered training. When Alice Hamilton, pioneer in industrial medicine, left Indiana after a year at a minor medical school, she was able to enroll at Ann Arbor, the university of her choice. But when she began to apply her interest in pathology to practical social situations in Chicago, as a resident of Hull House under Jane Addams, barriers were everywhere. Starting as member and managing director of the newly established Occupational Disease Commission in Illinois, working in the federal government during World War I, and finally teaching as Harvard's first professor of industrial medicine, Alice Hamilton witnessed dramatic changes in the structure of industrial protection: factory inspection and sanitary practices, compensation laws, industrial insurance, and an adequate scientific background for industrial medicine.

Looking back now, from retirement along a sun-dappled stretch of the Connecticut River, Dr. Hamilton recalls that when she was invited to join the Harvard faculty, women were not admitted to the Medical School; her name appeared sexlessly in the catalogue as a discreet "A. Hamilton," and it was delicately conveyed to her that she was not expected to apply for football tickets or use the Harvard Club.

To many a pioneer who came up the hard way, the lot of the science majors of the class of 1957 who are entering advanced study or employment this autumn seems a very easy one. This does not mean, however, that all bars are down. A few "No Admittance" signs are still posted: for instance, use of the 200-inch telescope at Mount Palomar is denied to women astronomers, on the ground that living facilities on the mountain are inadequate, though the 120-inch instrument at near-by Lick Observatory is unrestricted. Similarly, some industrial corporations still refuse to hire women engineers, on the ground that living conditions in the field are difficult. But their potential is illustrated by the work in electrical engineering of Hannah Chapin Moodey, trained at Smith, Rutgers, and M.I.T., who designs cathode-ray tubes in RCA Victor's Lancaster, Pennsylvania, laboratory for the development of color television.

Other types of restriction remain. One is the counsel that many young girls get when making up their minds about entering a profession. Interviewed in his private machine shop among boulders and birches at Belmont, Massachusetts, Dr. Vannevar Bush credited folklore with much of the reluctance of women to attempt disciplines based on logic, such as mathematics and physics. Promising youngsters, he remarked, are frequently scared off by the declaration: "Girls aren't good at math." Some girls, he believes, can be very good at it. Dean Gordon B. Carson of Ohio State's College of Engineering concurs: "There is still some social stigma and question in the high schools of the nation when girls major in the scientific-mathematics portion of the high school curriculum."

For whatever reason, it is a fact that while some 100,000 women graduate from college each year, five recent consecutive classes produced only 617 physics majors. One in four of them had studied at a liberal arts college for women, where they were freer from social expectations than they would have been at institutions attended jointly with men. Nearly one in eight came from five such colleges — Bryn Mawr, Mount Holyoke, Radcliffe, Smith, and Wellesley. The facilities of these colleges are frequently inferior to those of the big universities, but their competence is considerable — in recent years Mount Holyoke's chemistry faculty has provided three winners of the American Chemical Society's Garvan Medal. Industry is becoming increasingly aware of women's colleges as centers for the development of scientific skills — half of all women employed on technical work at Bell Telephone Laboratories, for instance, are recruited from this source.

But the main barrier to women's entry into certain fields today is not based on an assumption about what they can do, but on hard-bitten experience of what they do do. The reason why medical schools quota their acceptances of women students at around 5 per cent of total enrollment, the reason why corporations shy away from women



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applicants for jobs that require costly training, is summed up in one question: Why take a woman when, first thing you know, she is going to get married, have a family, and quit? Here is the center of today's professional resistance.

Now not all women marry. And not all of those who do marry and have families interrupt their work for more than brief trips to the hospital when their children are born. A great many continue to work on a part-time basis. Many of those who do quit come back later — the big recent additions to the labor force have been women over thirty-five.

But the two-way stretch of a home and a job, during at least part of a married woman's life, is undeniable. To solve this highly personal problem without quitting requires finding an employing institution that can accommodate itself to maternity leave, part-time employment, sudden emergencies. It requires a family in accord with the effort. It requires finding, for at least part of the time when the children are young, another woman who can relieve the scientist of the necessity of being in two places at the same time. And it requires a certain philosophy about scientific attainment: in today's competitive conditions, continuity of work is almost indispensable if one is to get as far as one might be able to go — as Vannevar Bush puts it, "Getting to the top on part time is doggone tough."

Yet the number of women who have found a workable solution to their problem is rising rapidly. How do they do it? One important element is the choice of a specialty. One that allows some flexibility is better than one which binds its practitioner to a strict or an unpredictable schedule. Some 18 per cent of women physicians are pediatricians, but Dr. Virginia Kneeland Frantz, professor of surgery at Columbia University's College of Physicians and Surgeons, attending surgical pathologist at the Presbyterian Hospital of New York, and mother of three, made this point in a recent piece of advice to women candidates for medical school: "It is rare to find a successful woman pediatrician who has had time to raise her own children. This specialty is full of emergency calls, and unless an unusually indulgent husband is willing to sit up with Junior's croup, a serious conflict may arise when the doctor is called out in the middle of the night by an anxious parent for croup which may be less dramatic than the one the physician had to leave unattended at home."

In a few occupations, a clean break while the children are young is not too costly: Dr. Alan Waterman of the National Science Foundation points to the acute need for science teachers in the secondary schools, and the possibility of science majors filling this need when their children reach school age. Scientific concepts change rapidly, but the fundamentals taught in introductory courses do not change as fast; a woman with good basic training can make up for lost time rather easily.

But in many specialties, to keep current enough to hold a place, a woman must stay on. The conditions of doing so are changing; there is a considerable difference between the experience of the women scientists who are now at the peak of their careers and those who are just starting their professional life.

A GENERATION ago, most women had a few years after college and before marriage in which they could get at least a rung or two up the professional ladder. In their day, families were apt to consist of two children; there was a favorable differential between professional salaries and the wages of hired help, and competent help was available. Dr. Evelyn Witkin, now biologist at the University of the State of New York, made a solid start at the Carnegie Institution before marrying a fellow scientist and having two sons. She took a year off at the time each was born, was on part time for five years. Her specialty allows some flexibility — though even the organisms of bacteriological research can enforce a schedule — and today she operates with a team of assistants. She notes, however, that while children are small, no woman can do all that she otherwise might in her scientific field, and that it is highly important to her family and to herself that she make peace with this fact.

For today's young women, by contrast, marriage is likely to come during or immediately after college, family plans include three to five children, help is scarce and costly. On the other hand, with half of all families complete before the mother is thirty, a girl who marries on leaving college will have a larger consecutive portion of her working life ahead of her when her youngest starts school. And with automation and related developments, a general shortening of working hours seems likely to reduce the stigma that now often attaches to part-time employment. At the beginning of her life as a married doctor, Theresa Long Siebert has so far worked close to full time. She and a classmate, David Siebert, got their M.D.'s from New York's Physicians and Surgeons in 1951. At first review, two doctors in one family seemed too complicated a prospect; she departed for Strong Memorial in Rochester while he interned in New York. But the next June they married.

That August he went into the Air Force. During his indoctrination period she served for six weeks in a thirty-bed private hospital at Wee-



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tumpka, Alabama; in December she followed him to the site of a future jet base in Germany. There she became assistant to the surgical director of a German hospital; as her German improved, she worked in the clinic. As soon as the base was in use, the Air Force hired her as a civilian physician. Laurel was born in Wiesbaden in March, 1954.

Back in New York, her husband began a four-year residency in surgery. She decided to become a radiologist — with a referral specialty, she will not be the first doctor called and her working hours can therefore be fairly regular. In Germany, Theresa Siebert had thought of solving her child-care problem by bringing her German help back with her. But her mother, left a widow with children at home, decided to earn income by foster care. Laurel is cared for in her apartment daily.

Toward the end of 1956, the necessary permissions for a second child had been obtained: her mother was willing to help care for it, and the hospital was willing for her to cut down on fluoroscopy during pregnancy in view of the radiation hazard. This April she passed the examination of the American Board of Radiology, finished her residency just in time for the accurately calculated birth of the second baby. As soon as her husband's residency is completed, the Sieberts plan a joint search for new pastures in some small community.

THE husband-and-wife team is an institution which, from the Curies to the Coris, has provided many married women scientists with the flexibility that they need. It may be a simple partnership such as that of Louis and Pauline Moyd, consulting geologists retained by companies engaged in the use of minerals. The Moyds' office is in their Yonkers home, where the thirteen-year-old twins are based, with a housekeeper in charge. Mrs. Moyd's specialty is the firm's research work: her thick reference files list the location and characteristics of known deposits, make quick checking easy when prospectors visit client corporations with gleams in their eyes and stories of mountains of new-found ore. She is the research and procurement officer when contracts call for analysis of costs of exploitation — production expenses, extent of market, tax status — or establishment of an operation from the purchase of machinery to the hiring of staff. This year, the first woman to do so, she organized and moderated a session at the annual meeting of the 87-year-old American Institute of Mining, Metallurgical and Petroleum Engineers.

Some husband-and-wife teams are more complex than the Moyds' simple partnership. The Haskins Laboratories is a private, nonprofit organization in the field of pure research employing a considerable staff, started by Caryl P. Haskins when Edna F. Haskins was still a brilliant physical chemist at King's College, Durham, England. For a number of years after their marriage, both centered their work in the Laboratories besides serving on its directing board; now they are in Washington, where he has succeeded Vannevar Bush as head of the Carnegie Institution, and she is continuing her work.

The 33-year-old firm of Foster D. Snell, Inc., is a commercial operation in the field of applied science filling a ten-story building in lower New York; Cornelia Snell, former mathematician who shifted to chemistry, is its specialist in reference work. When the firm is called on for expert witness in a patent case, she prepares evidence. When a hearing is called after an industrial accident like last summer's New York dock explosion, she organizes the testimony. Covering some hundred American trade journals monthly, she assembles information to the specifications of foreign clients. When a customer commissions the laboratory to develop a special product (the unwettable glass for Navy planes came from the Snell firm), she makes a search before research starts, to find out how — and how not — to go about it. In the American Chemical Society, she has been secretary and chairman of the New York Section, and a national councilor.

MARRIAGE into a scientific partnership is a rather special arrangement. Most women who enter science find their place as part of the staff of a private corporation, a government agency, a nonprofit institution, a university. Over the country, here is what some of the topflight women are doing, in various scientific fields.

At General Electric's superb new laboratory at Schenectady, New York, physicist Katharine Blodgett found how to make the nonreflecting glass now used for camera lenses. Dr. Blodgett is very matter-of-fact about research: "More often than not, you do the experiment and then think of it afterwards. If you'd known how to do it in the first place, you would have done it more directly." In the course of her investigations of the characteristics of films on water surfaces, Dr. Blodgett found that a certain type of soft material could be deposited on glass and built up in accurate layers — their thickness was one ten-millionth of an inch. The layers absorbed light in proportion to their thickness; in Dr. Blodgett's office, a piece of glass on which there is a sequence of steps, each a millionth of an inch thicker than



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the preceding, reflects a brilliant spectrum. Applying her discovery to the specific problem of the reflection of the light on lenses, Dr. Blodgett found that if a coating four millionths of an inch thick were put on both sides of a piece of glass, almost no light at all was reflected — and nonreflecting glass for commercial use got its start. Today Dr. Blodgett is working on properties of atomic hydrogen.

At the Argonne National Laboratory at Lemont, Illinois, chemist H. Gladys Swope is in charge of disposal of radioactive waste. Starting in her student days as stenographic help at the Chicago Sanitary District, she rapidly edged her way around the glass partition that divided the office from the laboratory, became a specialist in waste disposal, and has never had time to finish her Ph.D. At the Argonne, waste disposal consists of extracting radioactive substances from the water used in operating the reactor and in the laboratories. Miss Swope is likewise in charge of Argonne's gamma irradiation facility, started two years ago, where experiments in sterilization without heat are carried on both for government accounts, such as the quartermaster food container project, and for private commercial firms, most of them concerned with the packing and packaging of food.

At the Carnegie Institution's Long Island Laboratory at Cold Spring Harbor, plant geneticist Barbara McClintock has been working eleven years on a corn-breeding experiment. More than most of today's scientists, she is a lone-wolf investigator, living for the excitement of finding things out, embarrassed when honors are thrust upon her, restive at the organizational responsibilities that go with position, uninterested in financial returns — and withal, merry. "Scientists," she comments, "should be dedicated but not consecrated."

Dr. McClintock wants no assistants, believes that immediate familiarity with each phase of a plant's development is essential to the geneticist's grasp of clues. That is how, quite suddenly, she recognized the hypothesis about the growth process on whose verification she has been working: "It looked at me." Her assumption is that the nucleus of a cell contains a complex intranuclear system which triggers successive genes into action as the plant grows. Understanding of this triggering mechanism should make possible control of growth and the production of preferred types of plant from selected material.

Recently Dr. McClintock's material — her ears of corn, grain by grain, have long and meticulously kept genealogies — has been used by other researchers. She welcomes substantiation of her findings by their duplication of her experiments, but as a geneticist she is concerned not with what is commercially useful but with what is true.

Back in the 1920s, Dr. Sarah M. Jordan of Boston was one of three medical students whom Dr. Frank H. Lahey asked to join him in the establishment of a group clinic. Started in the apartment across the hall from the one where the Laheys lived, the clinic now occupies four blocks of tall buildings, offering diagnostic work in all specialties except obstetrics and ophthalmology. Dr. Jordan directs the department of gastroenterology. When asked whether she thought that women doctors are more likely to attract patients if they go into certain specialties like pediatrics or dermatology, she replied: "I've never noticed a difference — but then, so many men have ulcers." Her patients at the time included Sir Anthony Eden.

Development of the Blalock-Taussig operation, whose purpose is to turn blue babies to a normal pink, is a parallel example of the opportunity offered to women scientists by membership in a large organization. In 1930, at the Johns Hopkins Hospital, Dr. Edwards Park put Dr. Helen B. Taussig in charge of the Children's Heart Clinic. As she accumulated a file of X-ray records, some of them substantiated and elaborated by autopsy findings, even though surgery of the heart had never yet been attempted, she began to dream of a heart operation to provide a blood supply to the lungs of cyanotic children who lacked it because of congenital defects.

Normally, when extrauterine life begins at birth, the *ductus arteriosus* which has provided the child's blood supply closes and circulation of blood to the lungs begins. In 1942 Dr. Alfred Blalock, who was interested in vascular surgery before he came to the Hopkins, performed his first operation closing a *ductus* which had failed to close naturally. When it was over, Dr. Taussig congratulated him but said, "The truly great day will come when you build a *ductus* to supply the lungs of a cyanotic child." Just over two years later, after experiments on laboratory animals, Dr. Blalock did exactly that. Since then, 1500 such operations have been performed at the Hopkins.

In preparing for such an operation, Dr. Taussig designates the cases which she believes will benefit from surgery, and supplies the surgeon with the most complete information possible as to the nature of the malformation which he will find, and the best angle of approach. Sometimes the change in color takes place while the child is still on the operating table.

Women scientists at colleges and universities



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have a double opportunity: that of pursuing their own research, and that of capturing the imagination of the next generation and attracting it into their specialty. Cecilia Gaposchkin, now a full professor of astronomy at Harvard, started her academic life at Newnham College, Cambridge. When Harvard's Harlow Shapley was abroad on a lecture tour, she asked if she might come to work with him for a year. That was thirty-five years ago, and she says there is more to do now than when she started. In her study, across desk and tables, large graphs show the spectra of heavenly bodies, particularly the hot stars. Some of these vary in brightness with a rhythm more constant than a clock. Others are new stars that explode, usually once and for all. Dr. Gaposchkin observes the geometry of the explosion, noting what flies off, in what direction, how fast.

The decision of Barnard-trained Henrietta Swope to become an astronomer was likewise firmed up by a Shapley lecture, this time at Nantucket's Maria Mitchell Observatory. Now research assistant to Dr. Walter Baade at Palomar, she too works in the variable star field, observing photographs, making color-magnitude diagrams — measurements of the temperature and luminosity of stars in globular clusters or galaxies, extended over time, indicate the evolution of stars within a system.

While astronomers measure the energy of stars, an effort to harness the sun's energy goes forward at New York University. Hungarian-born Maria Telkes, in her childhood, saw a French print of a solar machine — *Vue générale de mon grand appareil exposé au Trocadero en 1878* — which now hangs on her office wall. Ever since, she has been engaged in solar energy research: a method for distilling drinking water from sea water, used on life rafts in wartime by downed airmen; a solar oven; a solar house.

At Columbia University, when the elevator reaches the floor where Dr. Chien-Shiung Wu's laboratory is located, the door opens on a sign, "No radioactive materials permitted beyond here." Dr. Wu has worked on nuclear physics almost from the first developments in the field. Daughter of a scholarly family in Shanghai, she graduated in the 1930s from National Central University in Nanking, came to the University of California for a Ph.D. under Dr. Ernest Lawrence, took part in the Manhattan project, and now investigates nuclear forces and structure, particularly beta disintegration, as a member of the Columbia faculty.

Science had not been a family specialty, but Dr. Wu points out that the scientific method — make a bold assumption, then engage in a painstaking proof — is by no means foreign to Chinese thinking. Early this year, Dr. Wu and two fellow Chinese physicists, Dr. Tsung Dao Lee of Columbia and Dr. Chen Ning Yang of the Institute of Advanced Study at Princeton, made scientific news when the two latter made a bold assumption and Dr. Wu devised a painstaking proof.

The law in question was the so-called "parity" law: that objects that are mirror images of each other must behave the same way. For the past four years, physicists have been puzzling over observed behavior that did not fit this law. Then Drs. Lee and Yang decided that the law was as unnecessary as the nineteenth-century assumption that light waves were conveyed by a mysterious substance called "ether." Dr. Wu thereupon set up an experiment which did to "parity" what the famous Michelson-Morley experiment did to "ether." At Washington's Bureau of Standards she and her co-workers oriented the spin of the radioactive cobalt nuclei at an extremely low temperature so near absolute zero that random thermal movements were all but eliminated, and the disintegration of radioactive atoms could be observed with a minimum of other effects occurring simultaneously. Under the "parity" concept, the electrons should have shot off in paired directions. They didn't. A second experiment by two other scientists confirmed the failure of the law.

Dr. Wu summarized her findings tersely: "Parity was not observed." Subsequently, the former United States Ambassador to Italy, Mrs. Clare Booth Luce, lauded Dr. Wu for her work in connection with the refutation of the nuclear principle of parity. As between men and women scientists, she said, in the case of Chien-Shiung Wu, parity most definitely is observed.



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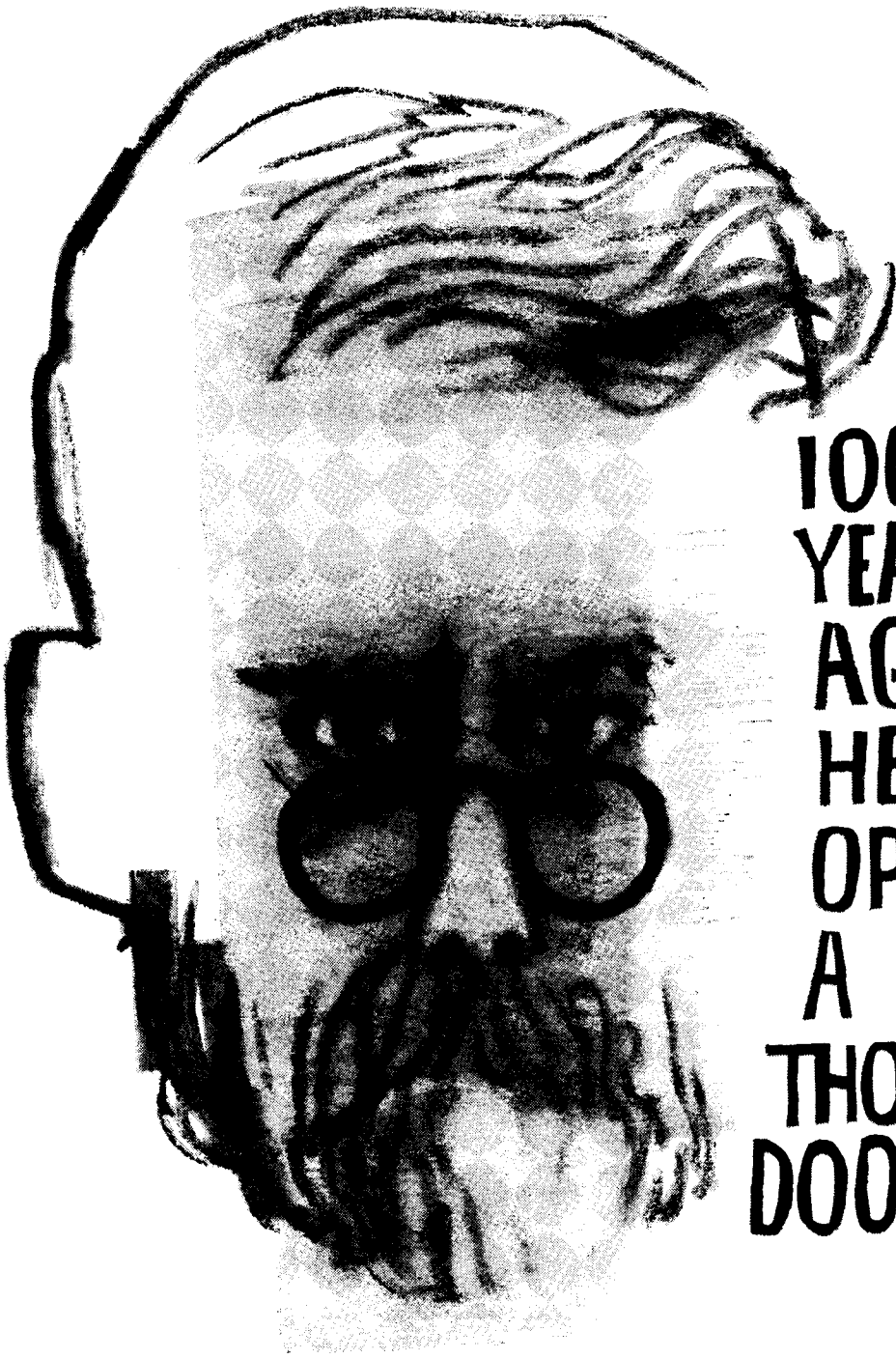

# 100 YEARS AGO HE OPENED A THOUSAND DOORS...

**IN 1857,** a research chemist in France announced to the world that fermentation is caused by living organisms. Again, Louis Pasteur had changed the course of science.

Researchers who followed him at the frontiers of experimental chemistry saw a thousand opportunities to harness these microscopic living organisms to the service of mankind. If *one* microbe could turn the juice of grapes into wine, then surely others in the infinite variety of molds, yeasts, fungi and bacteria could work even greater feats in the production of valuable chemicals or other products.

Out of the new science of fermentation chemistry developed an industry that was to put billions of microbes to work.

Through one door opened by Pasteur, chemists of Chas. Pfizer & Co., Inc. sought a short-cut to the production of citric acid, a chemical important to many industries. In 1923, after ten years work, they succeeded in producing citric acid by the fermentation of ordinary sugar. With vast quantities now available, the world price of citric acid dropped more than two-thirds.

More recent triumphs achieved by Pfizer and other leaders in the field of fermentation research are as familiar as the word penicillin. Sixteen life-saving antibiotics plus many vitamins and hormones are the world's reward for this research. Compounds produced by fermentation chemistry (and in some cases, fermentation combined with organic synthesis) have drastically reduced mortality, increased food supplies and given new chemical tools to industry.

In the years ahead, scientific research will carry man's hope for an even better future into realms whose doors were opened by the genius of Louis Pasteur.

*If you would like to read more about the story of fermentation, write to Pfizer for the free, illustrated booklet, Our Smallest Servants. Chas. Pfizer & Co., Inc., 11 Bartlett St., Brooklyn 6, N. Y.*

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And what about the next hundred years? Using history as a springboard, a few predictions have already been launched.

For one, our man of the future should pass the century mark without breaking stride. There's good reason to believe that the aging process is accelerated by a number of causes. Pluck these away one by one, and the life span of the man of the future may exceed five score years. You'll be a youngster at 70!

Though his productive capacity may well be doubled, he will spend less time on the job. Long week-ends can be devoted to the pursuit of knowledge and an individual's development, as well as recreation at distant playgrounds, for transportation will be no problem.

A century ago, when James Russell Lowell was editor of the Atlantic Monthly, no one would dream of saying life begins at 70. But tomorrow?

Naturally, no one knows for certain, but it is a matter of vital interest to us at John Hancock. For, as man's life — through the years — has become longer and more rewarding, it has been possible for life insurance to provide a constantly larger measure of well-being and security for millions of people.

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# AS THE NATION GROWS YOUNGER

*by FRANK W. NOTESTEIN*

*The acceleration of our birth rate has had the experts guessing since the end of the Second World War.* FRANK NOTESTEIN, *director of the Office of Population Research at Princeton University, reports on this phenomenon and discusses what it will mean to our country in terms of jobs, opportunities, and standards of living.*

THE population of the United States has begun to grow younger. Individually we grow older with ever-increasing chances of survival, while collectively we have started to grow younger for the first time in our national history. The reason for the trend is of course the spectacular increase in the number of births since the war.

This collective drift to younger average ages will have a host of repercussions on the temper of our life. Indeed, these repercussions are being felt already in new pressures for schools, houses, and the sharply expanding urban development. As the younger groups gain predominance in the total population figure, will our economy become more dynamic and will our leaders in industry and government take over at an earlier age?

This trend to a younger average age is new in the Western world. Our populations had been getting older for a long time, and after 1930 they had been aging very rapidly. In the United States half of the population was under 17 years of age in 1820. The median age began to rise and had climbed above 25 by 1920. It was at a maximum of 30.2 in the early fifties. By 1956 it had fallen to 29.9, and there is a possibility that it will fall below 26 by 1975.

These small movements in the median age reflect rather marked shifts in the groups that are economically important — shifts that change the dependency loads of youth and old age and the balance of our labor force. It will be useful to see what they have been, how they have come about, and the ways in which they seem likely to move in the future.

The proportion of young dependents in the population declined progressively until 1950, when only 34 per cent of the population was under age 20. Then the mounting birth rates of the post-war years brought a reversal of trend, and by 1956 the figure had risen to 37 per cent. Meanwhile there had been a steady rise in the proportion of the aged. The proportion in the middle groups, from which the labor force is mainly drawn, rose steadily to a maximum of 59 per cent in 1940, and fell sharply between 1950 and 1956, when it amounted to only 54 per cent. This shrinking proportion in the working ages has probably been a considerable factor in minimizing unemployment during the post-war years.

Sharp changes in the rate of population growth have accompanied these shifts in age structure. In 1950 our population was twice as large as it was in 1900, yet until 1940 the rate of growth had been slowing. The rate rose a little before and during the war and then shot up with surprising speed. By the middle of 1956 the population had reached 169 million and was growing at an annual rate of 1.7 per cent. Such a rate is sufficient to change the character of our country in a short time. If it were to continue, a large majority of the children born last year would live long enough to see us a nation of half a billion people.

Before considering future possibilities, let us look more closely into the sources of past changes in our growth and age structure. The reduction of the death rate has been spectacular. It is hard to realize that, on the life table for 1954, a newborn white girl has a better chance of surviving to age 60 than she had of living to age 5 under the health conditions prevalent at the beginning of the century.

The average expectation of life at birth for white females rose from 51 years in 1901 to 74 in 1954. This improvement in longevity is sufficient to increase by nearly one half the size of the popu-



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lation that a given stream of births will maintain. The postponement of death has been a major support of our rate of growth.

It is widely believed that the lengthening expectation of life has also been responsible for the rising average age of the population. Long life for the individual, it is argued, must tend to give us an old population. Reasonable as this view seems, it is untrue. Improved chances of survival have tended to lower the average age slightly, as my colleague Ansley J. Coale has shown. And all ages in the span of life have shared in the improvement.

If the improvement were of equal proportions — say a 40 per cent increase — the age structure would be unaffected. Such a change would increase the rate of growth, but it would do so equally in all ages. In fact, since 1900 the improvement has been somewhat disproportionately large in the youngest ages, thereby particularly stimulating population growth in those ages. Changes in mortality since 1900 would have made our population slightly younger if nothing else had happened.

Meanwhile, however, our birth rate fell almost continuously, as part of a decline extending from the early nineteenth century to the late 1930s. It is this decline that checked our rate of growth and lifted the average age of the population. The birth rate began to rise a few years before the war, kept rather high during the war, and has been amazingly high throughout the post-war period. The story of its changing course is fascinating and has puzzled those of us who live with such figures.

The wartime revival in births had been interpreted as the product of an unusual situation that would soon pass. There had been a sharp decline in the age at marriage. The emotional pressures of the war, family allowances for men in the services, and general prosperity were stimulating early childbearing. But there was no evidence that an increase in the size of completed families was under way. The size of families had been falling for many decades, and a deeply probing investigation carried out just before the war strongly suggested that this trend was likely to continue. The wartime rise in births was, therefore, viewed as a shift to younger childbearing rather than as an increase in the number of children. It was thought to foreshadow not further increases in births, but a rather sharp decline.

The evidence leading us to expect a decrease in births after a post-war spurt seemed convincing to me, but instead of a decline there was a positive flood of births which has continued to the present time. Incredibly, from the point of view of a decade ago, the birth rate of the United States, at 25.3 in 1956, was higher than the birth rates of such traditionally fertile nations as Italy, Spain, Portugal, and Japan.

Interestingly enough, this post-war rise has been generally larger in urban than in rural areas, and in the upper than in the lower educational and occupational groups. As a result, the former regional, educational, and occupational differences in birth rates have been much reduced. It is to be noted that the rise has been most pronounced in precisely those sectors of the population that, in other circumstances, have shown their ability to restrict their childbearing quickly and effectively.

The significance of the 1956 experience is not entirely clear. If we imagine a group of women bearing children as they move through life at the rates at which women of corresponding age bore children in 1956, such an imaginary group would have an average of about 3.7 children apiece, or about 3.9 per married woman. This is a very high figure, suggesting perhaps that the recent rates of childbearing will not be sustained throughout the life of any actual group of women. Indeed, no actual class of women born in this century has produced as many as three children on the average. All of the classes in the childbearing ages are now well ahead of their immediate predecessors. The rise in family size is already achieved. But unless women continue to bear children much more rapidly than any experience of the present century would suggest, they will not attain any such average as 3.7 children.

The Office of Population Research at Princeton University is now conducting a rather intensive field inquiry concerning many of these matters. Data from it are not yet available but we do have the results of a pretest made in one metropolitan area. The wives interviewed were native white and had borne their second child a few months prior to the interview.

No one can read the records of these interviews and fail to be impressed with the genuine revival of interest in family life and children. The impression is wholly different from that given by similar records taken early in the 1940s, when the typical parents could scarcely imagine the circumstances that would make them want more than two children. In our small sample, which is far from a representative sample of the nation, about two thirds of the wives look forward to having three or four children, and those who want only two children tend to be apologetic about the small number. Few parents have qualms about being able to support and educate their children. Indeed, if all the children go to college whose parents plan to send them, we face the need for a



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staggering expansion of facilities for higher education. Nor is it all talk. A substantial proportion of these parents already have started savings accounts or insurance policies to provide for their children's college education despite the fact that their older child has not even started elementary school.

It is too early to have more than preliminary hints from this study, but it is perhaps worth noting that Catholics appear to want more children than Protestants. Among both Catholics and Protestants, the parents who attend church regularly tend to want more children than those whose attendance is infrequent. There are also indications that the families wanting more children tend to be in the white-collar classes and well educated. They have fair incomes, are reasonably happy in their work, and are personally well adjusted. This is a very different picture than would have emerged in any metropolitan community prior to the war.

What the situation bodes for the future is not clear. One gets the impression of an element of conformity and pattern. Parents are now planning to have children because they want them, and not because they think them unavoidable. The large majority are practicing some form of voluntary restriction. We have, therefore, a demonstration that it is possible for a highly developed urban-industrial society to produce a setting in which parents will want enough children to support rapid population growth. The somewhat widespread fears of the depression decade that urban-industrial life and universal birth control would necessarily bring declining populations have been dissipated.

Nor is there occasion to swing to the opposite view that we are moving toward the re-establishment of the large-family system which characterized our early nineteenth century and characterizes most of the world's peasant societies today. The present situation represents only a larger version of the small-family system and one that yields birth rates much lower than those of the underdeveloped areas today. The existing situation may not continue indefinitely. Given a new set of strains or a new shift of standards, perhaps as suburbs outgrow themselves, parents could reduce their childbearing quickly. For the immediate future, however, there is no sign of a sharp drop in fertility, although birth rates may decline somewhat, simply because women of childbearing age are forming a smaller proportion of the total population.

The future course of migration will also influence both our rate of growth and our age composition, but unless past restrictive policies are relaxed the effect will not be large.

We must now consider the bearing of the foregoing discussion on the future trends of growth and age composition. The accompanying charts present the highest and lowest projections issued by the Bureau of the Census. These results should be thought of as illustrating the consequences of specific assumptions about future trends in fertility, mortality, and migration. If the reader does not approve of the assumptions, he can introduce his own modifications to see at least the direction of change that they would yield. Both the "high" and "low" projections assume something over a million immigrants in successive five-year periods, and a continuation of the downward trend of mortality until 1960. The high projection assumes that the fertility rates of 1955 will continue until 1975. The low projection assumes that fertility will decline to the pre-war level by 1975.

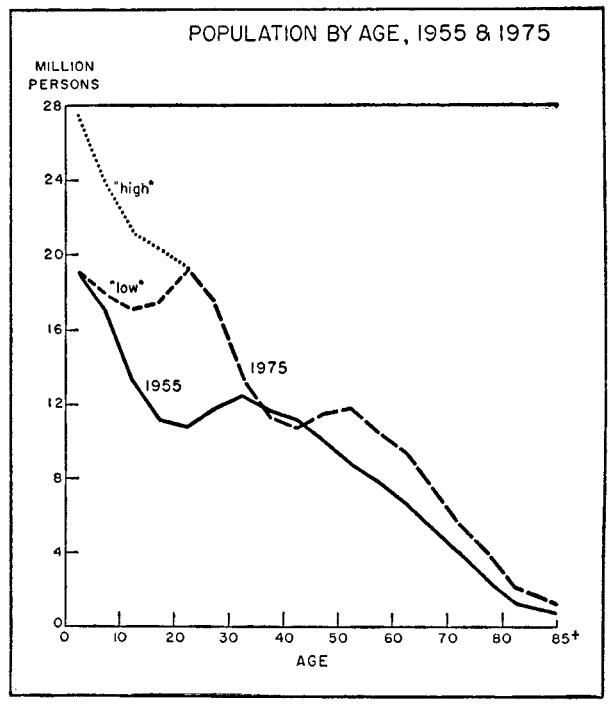


Figure 1

As may be seen from Figure 1, the high projection gives us a population of 229 million by 1975, representing an increase of 63 million over the 1955 figure. A projection made in our office at Princeton, which assumes the maintenance of fertility at the 1956 level and a continued improvement of mortality until 1975, implies an increase of 70 million and a total of 236 million by 1975. Even if fertility should fall drastically by 1975, as in the low projection, the population would still increase by 42 million and reach a total of 208 million by 1975. The high projection



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drops the median age to 25.8, only a little above the figure for 1920, and even the slower growth of the low projection carries the median below 29 years. It is difficult to find an assumption, apart from that of major catastrophe, under which the next two decades can bring anything but rapid growth and a trend toward a younger population.

The peculiar age distribution from which the projections start in 1955 will have important effects as the survivors move on in age. This 1955 distribution is shown in Figure 2. The large numbers under age 10 represent the survivors of births in the past ten years plus a few immigrants. The trough from ages 10 to 30 reflects the small number of births from 1925 to 1945, and the relatively large number over age 30 reflects the larger birth classes before 1925. We can see one of the reasons for the high rates of pay being offered to workers just out of school in the small numbers aged 15 to 25. The high income that scarcity brings to them doubtless helps to explain the frequency of young marriages. Small numbers, which are further reduced by the prevalence of higher education and early childbearing, help to account for the current shortage of stenographers.

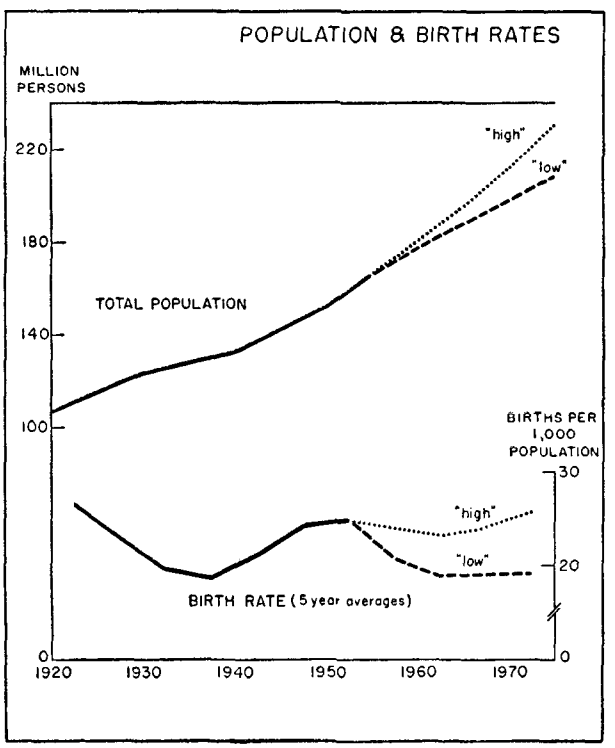


Figure 2

By 1975, the trough in the age distribution lies between ages 30 and 50, as may be seen from Figure 2. The population between 35 and 45 is smaller than at present. Above age 45, however, the gains are very large, and between 20 and 30 they are even larger. Ages 20 to 25 have 9 million more people in 1975 than in 1955, representing an increase of 79 per cent. By 1975 there should be no dearth of entering workers. Quite possibly the large supply will check wages for young people, curtail marriages, and cut the birth rate. College graduates may even be a dime a dozen.

The group aged 15 to 20, which is of special interest to high schools and colleges, will increase about as rapidly as that aged 20 to 25, if the birth rate stays high until 1960. It rises from 11 million to 20 million on the high projection, or about 81 per cent. With the trend toward universal higher education, it is possible that the increase in students between 1955 and 1975 will be several-fold.

If fertility follows the high assumption until 1975, the number under age 20 rises to 93 million, which is well above the total population of 1900. It represents an increase of 32 million over the 1955 figure. Even if fertility falls sharply to its pre-war level, the population under age 20 would increase by about 11 million between 1955 and 1975, reaching a total of about 71 million at the latter date. Both alternatives have a dip at ages 10 to 15 in 1975 that echoes the older trough as it moves through the childbearing years. The same situation is reflected in the projected course of the birth rate shown in Figure 1. The most notable effect of the low fertility assumption is the magnitude of the new trough that it would introduce into the age distribution.

WHATEVER the future course of the birth rate, within the limits considered here, it is evident that our population will increase rapidly, that growth will be most rapid among the old and young ages and least rapid in the middle range, and that we shall have a declining average age. The growth and shifting balance of the age groups are bound to have important economic consequences. Among them we must distinguish two types: one relating to the level of economic activity and the other to the productive balance at any given level of activity.

So far as the future level of economic activity is concerned, the demographic situation in the near future looks highly favorable. Growth undoubtedly tends to stimulate economic activity in a wealthy country that at times has experienced difficulties in maintaining a sufficient demand to utilize fully its productive facilities. The task of providing the goods and services that will be required in the next twenty years for an expansion ranging from one quarter to one third or more



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of the present population should give no small amount of stimulus to the economy.

When, as in our case, this growth is especially rapid outside the working years of life, the stimulus to the labor market should be particularly strong. This trend is marked between 1955 and 1965. In the census projections the population outside the working ages grows from two to three times as fast as that between 20 and 65 years. Until 1965 the slow growth of the working ages should furnish a powerful buffer to the risks of unemployment that might come as automation replaces both industrial and clerical workers. Indeed, thanks to our peculiar age structure, we may go far in achieving the productive gains of automation without a major disruption of the economy.

From 1965 to 1975 the situation is less clear. By that time the huge birth classes of the post-war years are entering the labor force. Even so, if fertility stays high, the increase outside the working ages will be more rapid than that in the working years. If, however, fertility should fall, as in the low projection, persons of working age would increase about four times as rapidly as those in the dependent ages. Given this course of events, the contrast between the two decades would be extremely sharp and require major economic readjustments.

FLEXIBILITY will be needed to meet this rapid shift from a scarcity to an abundance of young workers, but the demands of growth itself may go far toward producing that flexibility. We can only speculate about the changes in the spirit of the times that may come as our center of gravity and leadership shift toward youth. With our problems of stark poverty essentially solved, shall we simply go on to progressively higher standards of living with ever-heavier drafts on our own and the world's resources? Or will the outlet for new energy come in leisure, and if so of what nature? Will it carry us to new levels of education and cultural achievement? Or will the expanding energy be channeled into new efforts to meet world-wide responsibilities? No one can be certain of the answers but, given peace, our youth growth and productive power provide a dynamic combination that is certain to find exciting outlets.

A word of caution is necessary about the above line of argument. It leaves too many factors out of account. By no means are all of the elements associated with population growth fortunate for the nation. Space for living and recreation will be in progressively short supply, and privacy progressively expensive. Escape from the city will become increasingly difficult as suburbs grow into cities. Shorter working hours may well be canceled by longer hours of travel between home and work. Many standards of quality will decline as pressures for quantity rise. Whether one views progressive crowding as fortunate or unfortunate is largely a matter of taste. The frontiersman thought that two persons per square mile represented intolerable crowding, whereas the resident of Europe or Asia finds our land almost empty today. Undoubtedly, as growth goes on, our own standards will change. Speaking for myself, however, I should prefer the qualitative opportunities that go with slower growth and smaller numbers.

A considerable part of the stimulus arising from the prospects for rapid growth appears to be psychological. We seem to be greatly impressed by the tangible growth in numbers and insufficiently impressed by a host of other factors that can bring economic expansion. The demand for goods and services could easily fall in spite of rapid population growth; and, conversely, it could rise rapidly with only a slow population growth. Population growth provides some stimulus to the economy, but a general belief that it is very important intensifies the effect.

Perhaps because of our experience with depressions, we tend to be preoccupied with the problems of maintaining economic activity to the neglect of other equally important elements of prosperity. Such matters as the ratio of workers to dependents and the relation of total numbers to resources and living space are of basic importance. In fundamental terms the argument based on economic activity is a curious one. Our economic prospects appear to be favorable because we shall have to devote our productive energies to providing for additional tens of millions. Indeed, the prospects are viewed as particularly bright because this rapid expansion has to be undertaken by a population of working age that is increasing very slowly. In short, they are bright because the load on the productive ages is going to get heavier. The situation is anomalous in the extreme. Instead of counting on population growth to serve the needs of the economy, we ought to give more attention to the ways in which the economy could be made to serve the needs of the population.

In the immediate future this preoccupation with the need for youth and growth to maintain prosperity does not seem to be particularly dangerous. The nation is getting much pleasure from its new abundance of young life. In the long run, however, the situation may become serious. We cannot stay young without growing, and we cannot grow indefinitely without paying the penalties of huge size. The low census projection gives



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208 million in 1975; the high, 229 million. Maintenance of the fertility of 1956 would carry us to something like 236 million. Short of catastrophe, it is difficult to see the terms on which we shall be much under 300 million by the year 2000, and a continuation of last year's rate of growth to that date would bring us to almost 360 million.

THE United States is one of the very few highly developed countries in which the population is growing younger, but the trend toward growth and youth is typical of the underdeveloped nations of the world. Rapidly falling death rates, coupled with birth rates at least 60 per cent higher than our own, are stimulating growth throughout the underdeveloped parts of the world and increasing the already heavy burdens of child dependency. It is characteristic of such countries to have more than 40 per cent of the population under 15 years of age.

In our case, we may welcome the trend toward growth and youth at least for a time. As the world goes, we are not yet heavily populated. We have rich natural resources, a highly developed economy, a technologically skillful labor force, and ample capital. The trend toward growth and youth has an entirely different meaning where almost all of these assets are lacking and the population densities are already enormously high, as for example in China, Egypt, India, and Java. For them the new growth and added burden of young dependents represent a heavy drag on their struggle for improved living conditions. The only way in which they can ease their burdens, while retaining their gains in health, is to cut the birth rate. A number of them, including India, China, and Egypt, are beginning to bend their efforts in this direction.

A huge accretion in numbers, such as that implied by the continuation for several decades of our present rate of growth, would put an enormous strain even on our own relatively rich resources. Undoubtedly, technological advance will do as much to ease the strain in the future as it has in the past. We could doubtless absorb such growth without reducing per capita income. Whatever the technological situation may be, the smaller population size gives us more raw materials per capita with which to make our living. Before many decades we must balance the advantages of youth and growth against the liabilities of an enormously congested country. Without growth, the only way for a population to stay young is to die early. If we are to avoid unending growth, the population, like its individual members, can live longer only by growing older.

## FORESIGHT IN THE ATLANTIC

On one point the American is determined: he will not live near his work. You shall see him in the morning, one of sixty people in a car built for twenty-four, reading his paper, clinging to a strap, trodden, jostled, smirched, thrown into harrowing relations with men who drink whiskey, chew tobacco, eat raw onions, and incontinently breathe. . . . The future of transportation in our cities is a serious problem, which may be solved in an unlooked-for manner, by not solving it. . . . It is probable that much of local travel in the future will be over elevated roads and through tunnels.

— Charles M. Skinner, June, 1902

The practical uses of electricity are introducing new features into the whole subject of molecular physics, and in this region, I suspect, we are to look for some of the most striking disclosures of the immediate future.

— John Fiske, July, 1896

In truth, America has become a nation of science. There is no industry, from agriculture to architecture, that is not shaped by research and its results.

— W. J. McGee, August, 1898

When the electric wire shall stretch from Peking to London . . . when the endless circle is formed . . . then who will know the world we live in? Time no more! Space no more! Mankind brought into one vast neighborhood.

— T. Walden, May, 1862

The improvements in the microscope have led to the germ theory of disease, the discovery of antitoxin, and to that greatest boon to mankind, the realization of the importance of aseptic surgery. And the result of the study of electric discharges is now leading to methods of communicating electrons to the tissues or of setting them free. Violet light can set free electrons from metals; X rays can do the same. It is claimed strenuously by good authorities that there is a healing action in malignant skin diseases, due to this new electrical radiation. It is also claimed that the new radiation can aid, or in certain cases retard, the germination of seeds.

A new branch of physical chemistry has lately been developed from the study of the infinitely little, which promises to be the most important science of the future.

— John Trowbridge, May, 1902



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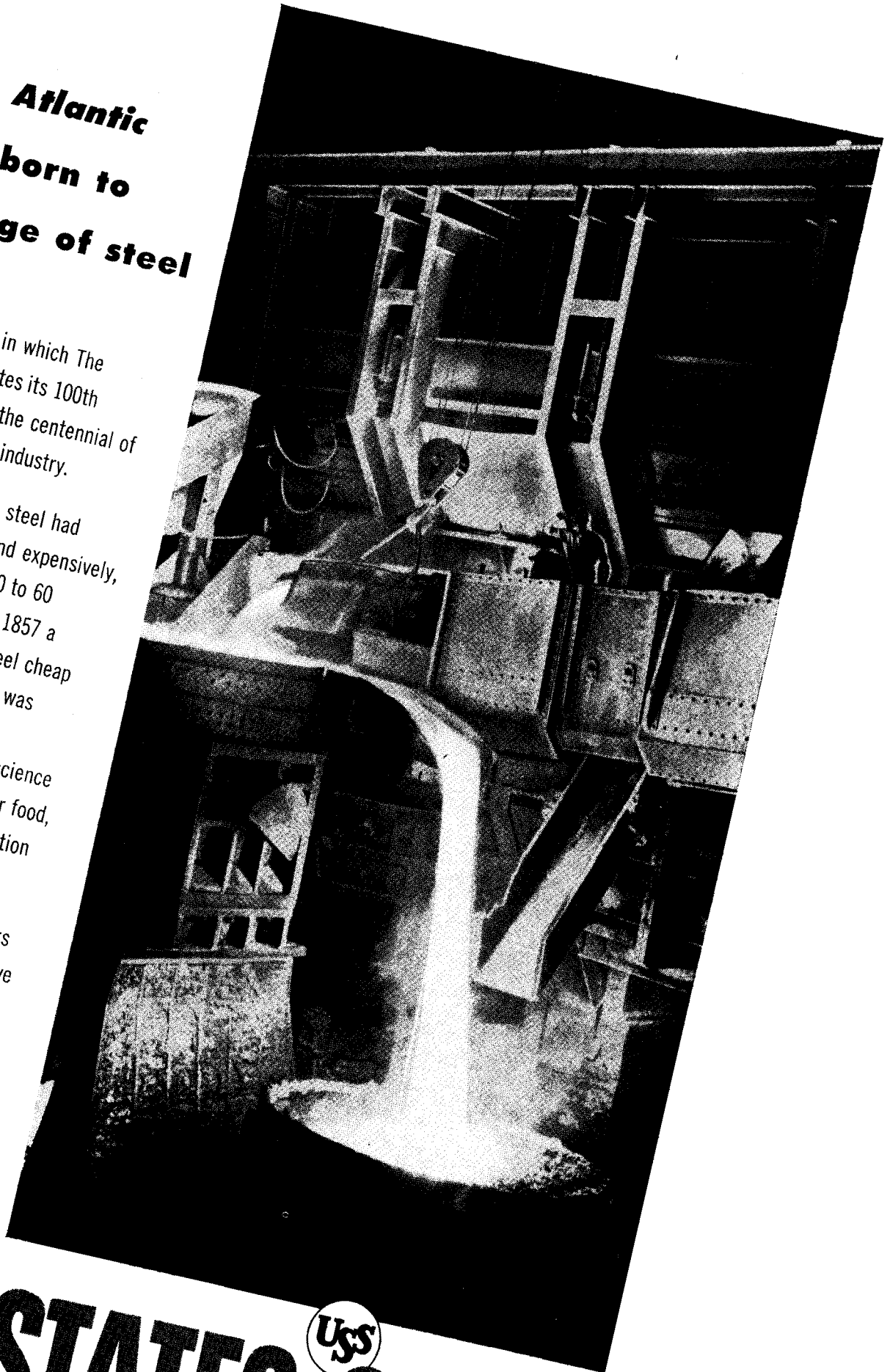

**UNITED STATES STEEL**

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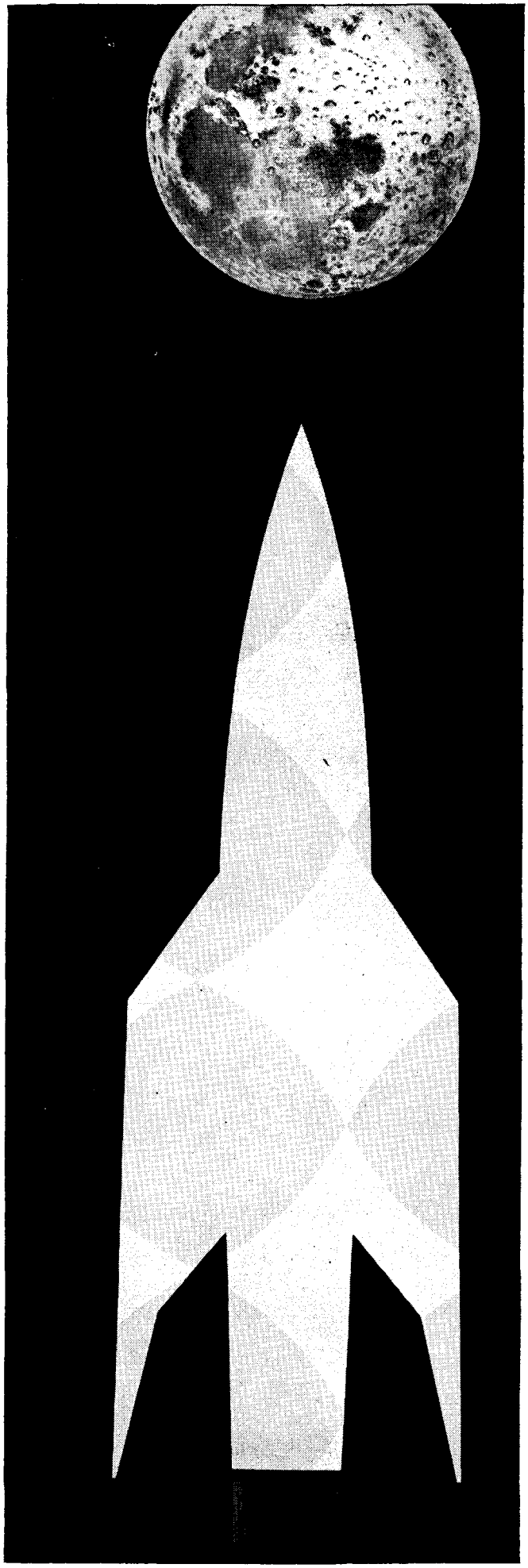


# Beneath the rivers and seas, to outer space...

INA people will play a part in the program to launch and track the first U. S. satellite. Cameras set up at Woomera, Australia, at Villa Dolores, Argentina, at Crater of Haleakala, Hawaii, and at other points of observation will photograph the earth-circling flight. Meanwhile INA men on both Pacific and Atlantic coasts are helping to prevent loss or damage to these valuable cameras and to other instruments used in the Optical Satellite Tracking Program. They serve without fee, as a public service.

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# MUTATIONS AND EVOLUTION

*by*

*EVELYN M. WITKIN*

When Charles Darwin began his voyage around the world aboard H.M.S. *Beagle*, he shared with his contemporaries the almost unquestioned belief that every species of plant and animal then inhabiting the earth had originated in a separate act of creation. No other way had ever been found to explain the exquisite adaptations of structure and behavior by which each form of life seems so perfectly designed for its place in nature. By the end of the five-year journey, an altogether new and startling idea had begun to develop in the mind of the young naturalist. Today, less than a century after the publication of *The Origin of Species*, the theory of evolution has long been accepted as a fact of life.

The brilliance of Darwin's insight lay in his integration of two simple and seemingly unrelated biological truths, and in his projection of their inevitable consequences on a vast scale of time. One was that the individual members of a species are not all precisely alike, the differences among them tending to be inherited. The other, somewhat less obvious, was that the infinite expansion of populations is checked by limitations in the availability of food, and by other restrictive conditions of life. It follows directly, reasoned Darwin, that any inheritable trait that enhances the survival and fertility of an individual will be "naturally selected" — that is, will be transmitted to a larger fraction of the population in each succeeding generation. In this way, by the gradual accumulation of adaptive variations, the species now existing have evolved from earlier and more primitive progenitors, and owe their intricate mechanisms of adjustment not to purposeful planning but to the impassive operation of natural laws.

In the great upheaval of scientific thought that followed the announcement of the theory of evolution, the phenomena of heredity and variation were suddenly thrust into the forefront of biology. Almost nothing was known of the way in which hereditary differences arise, and of the mechanisms of their transmission, but Darwin foresaw the development of a "grand and almost untrodden field of inquiry" in which the causes of variation and the laws of heredity would be discovered. Even as Darwin called upon the future to solve the mysteries of inheritance, Gregor Mendel was laying the foundation for

*Darwin's theory of natural selection, which was published practically simultaneously with the establishment of the* ATLANTIC, *opened new worlds to science.* DR. EVELYN WITKIN, *a brilliant young biologist at State University of New York College of Medicine in New York City, tells how genetics, a branch of science not yet born in Darwin's day, has carried forward our understanding of evolution.*



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the new science of genetics. Genetics has contributed richly to the synthesis of facts and ideas from almost every branch of the natural sciences that has been built upon Darwinism. As the diverse and intricate mechanisms of evolution have come to be understood, it has grown increasingly certain that the raw materials upon which they depend are the mutations of genes.

The hereditary endowment of a plant or animal is now known to be determined by a very special kind of material found primarily in the threadlike chromosomes that may be seen under the microscope in the nucleus of the cell. The invisible elements of which this material is composed, the genes, were once regarded as discrete particles strung along the chromosome like beads. Recent evidence has modified this concept considerably, and many geneticists now think of genes as chemically differentiated regions of the chromosome, not necessarily separated one from another by definite boundaries, but each having a distinctive structural pattern from which it derives a highly specific role in the metabolism of the cell.

Every cell in the body contains a set of chromosomes and genes, descended directly by a long line of cell divisions from the set originally constituted in the egg cell at fertilization. The human embryo develops into a person, rather than into a tree or an elephant or a monstrosity, because the material carried in its chromosomes, its constellation of genes, initiates and guides a marvelously coördinated sequence of reactions that leads inevitably, under normal conditions, to the differentiation and growth of a human being.

Throughout the life of the individual, the genes continue to exert their control over the complex chemistry of the cells and tissues of the body. As older tissue is gradually replaced by new tissue in the mature person, the food that is consumed is converted quite specifically into more of the very same individual, even though an identical diet, fed to a dog, would be transformed into more dog. We are a long way from understanding just how genes direct the manifold activities of living systems, but we know with growing certainty that the range of possible responses of any cell or organism to the conditions it may encounter is largely gene-determined.

All the members of our species have in common the basic genetic make-up that sets us apart from other forms of life. Nevertheless, no two individuals, with the exception of identical twins, have exactly the same heredity, which is another way of saying that every person possesses a unique pattern of chromosomal genes. Differences in skin pigmentation, eye and hair color, stature, and facial features are familiar hereditary traits by which individuals and groups of individuals differ from one another. These and the host of other inherited variations, from fingerprint patterns to blood types, are manifestations of the differences that exist in the structure and arrangement of the genic material.

Some hereditary variations, such as eye color, are known to depend upon differences in the state of a single gene. This does not imply that one gene, all by itself, is responsible for the formation of blue or brown pigment in the iris of the eye. It means that a change in this particular gene can alter the integrated functioning of the whole gene system so as to result in the production of a different kind of pigment. Other characteristics, such as height, depend upon the states of a relatively large number of genes.

Genes do not exist in a vacuum. They are always present in an environment that must be taken into account in understanding how they work. The environment within the cell and within the organism, and the more unpredictable environment outside, are intimately bound up with the functioning of genes and have varying degrees of influence upon the ultimate expression of heredity. A trait or characteristic is not, in itself, inherited. That which is determined by genes is the capacity to produce certain traits under certain conditions.

In the case of eye color, this distinction may seem unimportant, since an individual having the genetic constitution for blue eyes will have blue eyes under any environmental conditions. Its meaning becomes evident, however, when we consider inherited characteristics that are more directly responsive to environmental variables. The Himalayan rabbit is a case in point. This rabbit has a pattern of white fur, with black fur at the extremities (ears, tips of paws, tail), and this pattern is passed along from generation to generation. If a patch of white fur from the back of such a rabbit is shaved off, and the new fur allowed to grow back while the animal is kept in a cool place, it will grow in black instead of white. Thus it is not the pattern itself that is inherited, but the capacity to produce black pigment at low temperatures and not at higher temperatures. Since the temperature at the extremities is normally lower than that of the rest of the body, the typical Himalayan pattern is obtained. Similarly, although stature is basically under the control of genes, it can be influenced significantly by nutritional factors.

GENES are remarkable not only for the way they direct the intricate pathways of metabolism and development. They have, in addition, unique



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properties that give them special importance in biology, as the raw materials not only of evolution but probably of life itself. Genes have the ability to organize material from their surroundings into precise copies of their own molecular configurations, and they exercise this power every time a cell divides.

They are also capable of undergoing structural changes, or mutations; and once such a change has occurred, it is incorporated into the copies that the gene makes of itself. A single unit having these properties, and having also the ability to aggregate with other such units, would possess the essential features of a living being, capable of unlimited evolution through the natural selection of variant forms and combinations most efficient in reproducing themselves. Many biologists believe that life may have originated with the accidental formation of "naked genes," organic molecules able to duplicate their own structure, and their variations in structure, from materials available in the environment.

Although the chemical nature of genes is not yet known with certainty, one of the most important recent advances in genetics is the evidence that their definitive properties can be accounted for by the theoretical structure and behavior of the molecules of compounds known as desoxyribonucleic acids, or DNA. Chromosomes contain large amounts of DNA. Its molecules are very big, as molecules go, built up in long chains from only four kinds of simple chemical building blocks. The order in which these units occur, and the number of repetitions of similar groupings, are thought to be the basis of the specific activity of different regions of the chromosome — in other words, of genes. The study of the properties of these molecules provides a way to explain the mechanism by which genes duplicate themselves and reproduce the variations that they may undergo.

Mutations, as has already been suggested, are considered to be changes, on the molecular level, in the structure or organization of genes. A mutation in any gene is likely to be reflected in a modification of its contribution to the delicately interwoven pattern of control exercised by the whole constellation of genes, and may be detected by its effect on some physical or metabolic characteristic of the organism.

Mutations, in nature, are rather rare events, occurring usually with frequencies of from one in a thousand to one in a billion gene duplications. They have an extremely wide range of effects, from fatal disturbances of normal development to barely perceptible reductions of life expectancy, from striking changes in appearance to slight alterations of metabolism that can be detected only with sensitive laboratory instruments.

Mutations in man are responsible for the kinds of hereditary differences we have already discussed, and can produce, as well, such effects as early fetal death, stillbirth, diseases such as hemophilia and sickle cell anemia, color blindness and harelip. It seems quite possible that cancer, leukemia, and other malignant diseases may originate by the occurrence of mutations in body cells other than the reproductive cells.

Although the overall frequency of mutations can be increased considerably by exposure to radiations and a variety of chemicals, there is ordinarily no relation between environmental conditions and the *kinds* of mutations that occur. Mutations of all sorts arise in natural populations, with low but regular frequencies, in a way that is best explained by considering them to be the consequences of accidental molecular rearrangements, occurring more or less at random in the genetic material. X rays and other kinds of high-energy radiations increase the probability that these accidents or mutations will occur, but we do not know with certainty the causes of so-called "spontaneous" mutations. Natural radiations, such as cosmic rays, undoubtedly cause a fraction of them, but it has been estimated that the intensity of natural radiations is not sufficient to account for all the mutations that occur in plant and animal populations.

DARWIN believed that the inheritable variations upon which natural selection acts are caused directly by the influence of the conditions of life upon the organism, or by the effects of use and disuse of particular body parts. Although he appreciated the difficulty of explaining how the environment can provoke appropriately adaptive modifications, and how such changes can be incorporated into the reproductive cells so as to be inherited, it seemed at that time even more difficult to imagine that they could arise by chance. How, then, does modern genetics propose that the orderliness of evolution can follow from accidental variations in the molecular structure of genes, occurring without relation to the demands of the environment?

We do not need to rely upon speculation to answer this question. The study of evolution has moved into the laboratory, and while it is not possible to duplicate here the kinds of changes that have required millions of years in nature, the elementary steps of evolution can be analyzed. For this purpose, the use of bacteria presents many advantages. This is particularly true since the mechanisms of heredity and variation, wherever studied in the plant and animal kingdoms,



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seem to be fundamentally alike. Genes and mutations are much the same, in their basic behavior, whether they are investigated in fruit flies, in maize plants, in man, or in microorganisms.

The bacterium *Escherichia coli*, a rod-shaped, one-celled organism normally found in the human intestinal tract, is widely used in research on heredity. It divides every twenty minutes under optimal conditions, and a single cell, placed in one cubic centimeter of culture medium, will produce overnight as many descendants as the human population of the earth. The recent discovery of a sexual process in this organism, as well as in some other kinds of bacteria, has made it possible to interbreed different strains and to apply many of the classical methods of genetic analysis that were developed in the study of higher forms. *Escherichia coli* is an ideal vehicle for the experimental study of "microevolution."

In the laboratory, a strain of this bacterium can be maintained almost indefinitely, under constant conditions, without undergoing any appreciable change in its characteristics. When the environment under which the bacteria are grown is changed, however, in a way that is somehow detrimental to the population, it will often adapt itself rapidly and effectively to the new conditions.

A good example of the way in which a bacterial culture may adapt to an unfavorable environment is the reaction of *Escherichia coli* to streptomycin. Most strains of this bacterium are sensitive to streptomycin, and are unable to multiply in the presence of even very small amounts of the antibiotic. Sensitivity to streptomycin is an inherited trait and is transmitted, unchanged, through countless generations. If a high concentration of streptomycin is added to the culture tube in which a sensitive strain is growing, the outcome depends upon the size of the population at the time. If the number of bacteria in the tube when the antibiotic is added is relatively small (a hundred or a thousand), multiplication will stop at once, and no further growth will take place in the tube, no matter how long it is incubated. If the population is large (a hundred million bacteria or more), the addition of streptomycin will arrest multiplication sharply, but incubation of the tube for a few days will almost always result in the ultimate appearance of a fully grown culture containing tens of billions of bacteria. When the bacteria in this culture are tested, they prove to be completely resistant to streptomycin, and are able to multiply vigorously in its presence. Further, we find that resistance to streptomycin is a stable, hereditary characteristic, transmitted indefinitely to the descendants of these bacteria.

Thus, by exposing a large population of streptomycin-sensitive bacteria to a high concentration of the antibiotic, the emergence of a genetically resistant strain can be brought about. This, indeed, is a strikingly adaptive change, and at first sight it may seem to substantiate the old idea that the environment can cause useful modifications that are then inherited. The careful study of the events leading to the appearance of a streptomycin-resistant strain proves without doubt that this is not so.

It can be readily demonstrated, first of all, that the adaptation to streptomycin does not come about by the mass conversion of the entire sensitive population, but rather is the result of the selective overgrowth of the culture by a few individuals that are able to multiply in its presence, while the division of the rest of the population is inhibited. It is for this reason that adaptation occurs only when the exposed population is large enough to contain at least one such individual. The critical question is this: how did these rare individuals acquire the properties that enabled them and their descendants to multiply in the presence of streptomycin?

This question has deep roots in biological controversy. It recalls, in a new form, the arguments over Lamarck's idea that modifications of the individual caused by environment can be inherited by descendants. Although Lamarckism has long since been disproved to the satisfaction of most biologists by repeated demonstrations that such inheritance just doesn't happen, the idea has persisted in bacteriology until very recently that microorganisms are somehow quite different from other plants and animals, and that permanent hereditary changes of an adaptive kind can be produced in bacteria directly as a result of the action of the conditions of life.

Two alternative hypotheses can be considered in planning experiments to determine the true origin of streptomycin-resistant variants. The first is that a small number of initially sensitive bacteria were modified as a direct result of the action of streptomycin, thereby acquiring permanent resistance. This would be an example of an adaptive hereditary change caused by the environment, as Darwin envisaged the origin of most hereditary variations. The second possibility is that the resistant individuals had already acquired the properties necessary for resistance *before* coming into contact with streptomycin, as a result of a mutation during the normal division of the sensitive population. In this case, the role of the antibiotic would be entirely passive, providing conditions that favor selectively the multiplication of those rare individuals present in the



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population that are already equipped, by virtue of the previous occurrence of a chance rearrangement of a particular gene, to withstand its inhibitory action.

During the past fifteen years, a great many experiments have been designed and conducted in a number of laboratories for the purpose of determining which of these hypotheses is correct. They have established beyond doubt that the second one is right, and that streptomycin-resistant variants originate by mutation, at a very low rate, during the growth of sensitive strains that have never been exposed to streptomycin. The proof depends upon the demonstration that the very first generation of resistant individuals in a culture to which streptomycin has just been added already consists of related family groups, or clones, in just the way that would be predicted if their resistance were the consequence of a hereditary change that had taken place some generations back.

The development of resistance to streptomycin illustrates the way in which mutations provide the basis for adaptive changes in bacterial populations. Actually, any culture of *Escherichia coli*, apparently quite homogeneous when hundreds or even thousands of bacteria are compared, contains within it rare variants that differ from the predominant type in one or more of countless ways. When a suitable selective environment is provided, it can be shown that a culture contains mutants resistant to many antibiotics, to the action of radiation, to all sorts of chemicals that inhibit particular steps in metabolism — mutants that differ from the standard type in the sugars they can ferment, in their rate of growth, in the complexity of their nutritional requirements, in their antigenic properties, and in almost any characteristic for which a method of detection can be found.

In every case that has been carefully studied, these differences are found to originate without any contact with the conditions under which they happen to be advantageous, and their rates of occurrence are ordinarily not increased by such contact. This is true not only in bacterial cultures, where mutations can be demonstrated rapidly and dramatically. Natural populations of other plants and animals, including man, are known to contain mutations of many kinds that occur with no apparent causal relation to the conditions of growth.

Thus, in a way that Darwin could not have surmised, chance, through mutation, plays a most important part in evolution. It would be difficult indeed to imagine how a species could long survive, or progress in evolution, if it were dependent for its flexibility upon variations directly caused by the conditions of life. Quite aside from the fact that modifications produced in this way are not inherited, except in very special cases, it would require the intervention of some purposive and prescient agent to guarantee that previously unencountered conditions could typically provoke in the organism just those responses that are required to enhance adjustment.

Of course, the occurrence of a diversity of mutations in populations of bacteria and other organisms does not necessarily equip them to meet successfully every environmental challenge. Some strains of bacteria, for instance, are unable to adapt to streptomycin, since their spectrum of mutations does not include the particular modification of metabolism that is required for streptomycin resistance. Furthermore, since there are limits to the range of conditions that can support life, any sufficiently drastic changes, such as those that would take place in the center of a hydrogen bomb explosion, are not likely to prove conducive to the survival of any living thing.

Even within the range of more tolerable conditions, the suddenness of change is sometimes more decisive than its magnitude. For example, the bacterium *Escherichia coli* can be made resistant to streptomycin, penicillin, and chloromycetin, if the mutants resistant to each of these antibiotics are selected sequentially, but such a triply resistant strain cannot be obtained if the sensitive strain is exposed simultaneously to all three agents. This is explained by the negligible probability that any one individual in a finite population will have undergone mutation in three particular genes, each of which mutates very infrequently and independently of the others.

Observations of this kind, incidentally, although originally made in laboratories of genetics, have found important applications in medical practice. Many people who have used antibiotics to combat infection have had the experience of dramatic relief of symptoms, only to be followed within a few days by a recurrence, this time failing to respond to the same antibiotic. Sometimes this can be explained by selection of a variant, present in the infecting population of bacteria, that is resistant to the antibiotic and that has its chance to multiply once the sensitive population is eliminated by the first round of treatment. In some cases, a physician will recommend the use of a combination of two or more unrelated antibiotics simultaneously, knowing that mutants resistant to more than one such drug are much less likely to be present. While the use of combinations of antibiotics is not always feasible for medical reasons, under certain conditions it has effectively



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prevented the occurrence of relapses caused by selection of resistant variants.

There is, of course, much more involved in the complicated saga of evolution than the simple picture of mutation and selection that accounts for bacterial adaptation to streptomycin. Nevertheless, the continuity of life from its first stirrings, and its steady progress toward higher levels of organization, has depended, and continues to depend, upon the reservoir of adaptive responsiveness that is provided initially by the mutations of genes.

Why, it may be asked, if mutations are the source of evolutionary progress, do we hear so much about the genetic dangers of radioactive fall-out, overexposure of the reproductive organs to clinical radiations, and the heightened radiation levels of the atomic age? We know that radiations increase considerably the frequency with which mutations of all sorts occur. Mutations, in themselves, are neither good nor bad. Streptomycin resistance is good for *Escherichia coli* in the presence of streptomycin, but when the antibiotic is removed, many of the resistant mutants are unable to grow, some of them actually requiring streptomycin for growth. Similarly, radiation-resistant mutants are at a distinct advantage in the presence of ultraviolet light or X rays, yet, in competition with the sensitive form when no radiation is present, they die out rapidly. At any stage in the history of a species, under natural conditions, the mutations that are occurring have undoubtedly occurred before, and most of those that are advantageous under the conditions then prevailing have already been established as part of the predominant gene complex. Thus most mutations are bound to be harmful in some way; the most frequently occurring mutations in the fruit fly are known to be those having lethal effects. Increased mutation rates as a result of exposure to unnatural amounts of radiation, therefore, are likely to be injurious, not only to the individual progeny of particular people, but to the vigor of mankind.

While the genetic hazards of radiation are of most immediate concern, there are more positive implications of the new knowledge of genetics and evolution for the future of humanity. The degree of control that has been achieved over environmental forces, and over the constitutional infirmities that would otherwise reduce the chances of survival and procreation of a significant segment of mankind, has already weakened the hitherto unchallenged power of natural selection. If man should one day choose to put to use the far greater power of his conscious and purposeful intervention, his biological future will be shaped by his own hands. There are still undreamed-of possibilities in the multipotent clay that is his to mold.

## MAN-MADE SATELLITES

BY HUGH ODISHAW

The successful launching of a man-made satellite has an intrinsic excitement aside from its scientific meaning. Merely to place an object in the heavens — to create, in short, a new celestial body revolving about the earth like a small moon and obeying the laws of celestial mechanics — is an event without precedent.

The scientific significance of the satellite is several-fold. Until recent years, the important events and processes in the upper atmosphere have had to be observed indirectly. Life-giving and protective though it is, the earth's atmosphere masks events high above us. Indirect observations, often involving ingenious ground-based instruments and balloons, and deduction have been the sources of our knowledge. Satellites will permit man to project his senses far beyond the earth.

The currently planned set of experiments suggests the nature of the results to be expected from satellites. These experiments include cosmic rays, ultraviolet radiation, meteors, the earth's magnetic field in space, heat radiation balance, cloud cover, and electron density at satellite altitudes. Engineering studies of the satellite itself will also be carried by measuring such quantities as the temperature at various points and the erosion of the skin. In addition, radio and optical observations of the satellite from ground stations will permit the calculation of its orbit. Precise orbit determinations may yield information about the shape and structure of the earth itself — its oblateness, mass distribution in the crust, and the determination of positions of points on the surface of the earth.

The studies of heat radiation balance and cloud cover are basic to a better understanding of weather and climate. The first experiment contemplates a measure of total heat radiation to the earth and the total reradiation into outer space. Knowledge of this "heat budget" is essential to our fuller understanding of trends in weather and climate. Satellites also provide a means of observing cloud cover over the earth and following cloud formations. Information of this kind is invaluable for studying short-range weather trends and may permit accurate prediction of hurricanes and typhoons.

*Hugh Odishaw is the Executive Director of the U.S. National Committee for the International Geophysical Year, National Academy of Sciences.*



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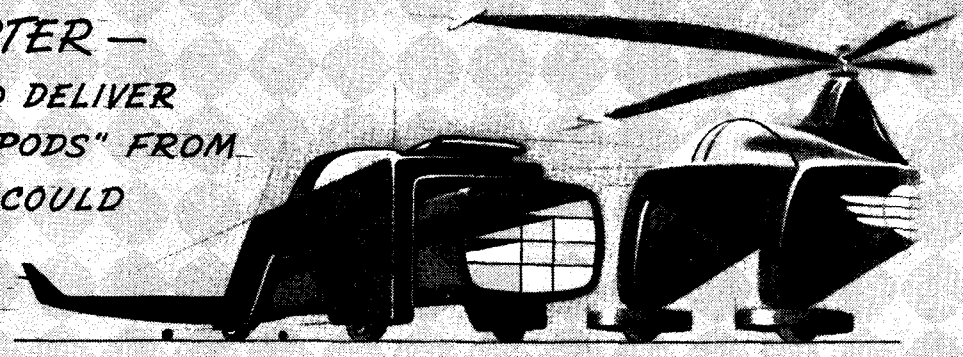

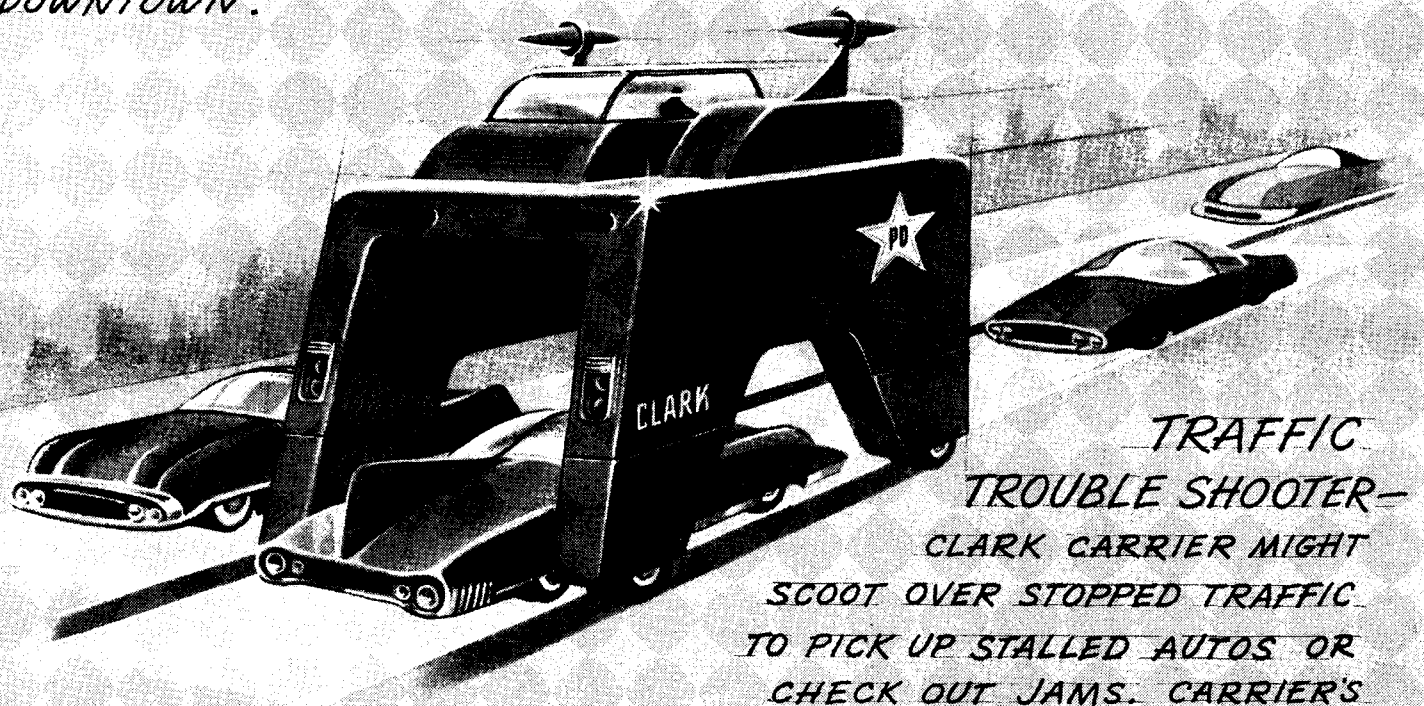


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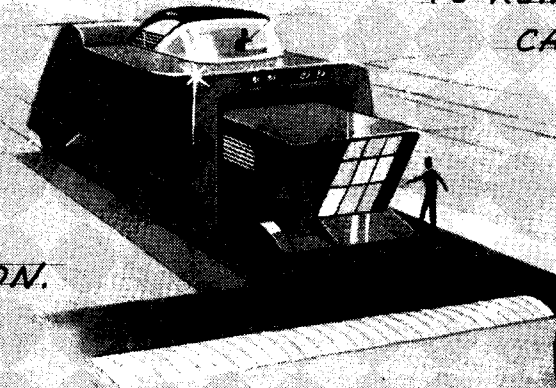

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# THE RARE EARTHS

## *Exciting new tools for chemical and industrial use*

a report by LINDSAY

Talk in management circles turns often these days to subjects that were science-fiction stuff only a few years ago. Commercial atomic energy, for example, and new materials that are revolutionizing industrial processes and products.

Among the chemicals that are challenging the serious attention of many research and production executives is that relatively little-known group of elements identified as the rare earths.

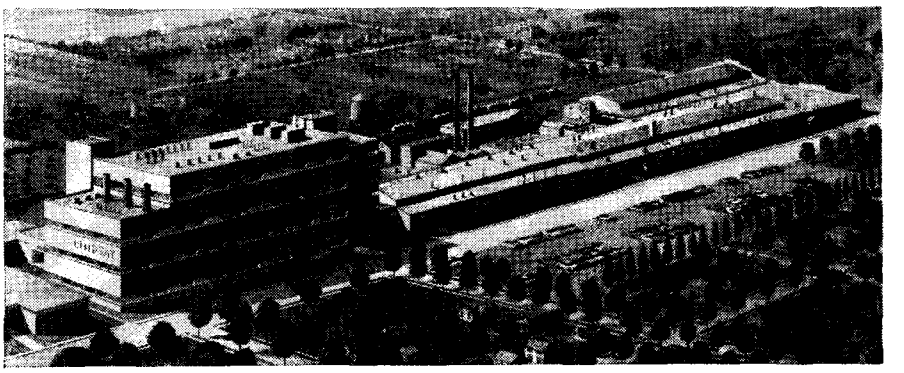
There are 15 rare earths—atomic numbers 57 through 71. Actually, they are not earths but trivalent metals. They are found in abundance together with thorium and yttrium primarily in monazite ore.

### 55 YEARS OF EXPERIENCE

Lindsay has worked with the rare earths for 55 years. In the early days, they were simply by-product wastes from our production of thorium nitrate used in the manufacture of incandescent gas mantles. No one suspected then the industrial potentials in our great piles of waste material.

A corner of the Ion Exchange Plant

However, in the early 1920's, after long research in extraction processes, Lindsay started commercial production of rare earth salts.



Lindsay Chemical Company monazite processing plant

They were quickly "discovered" by industry and put to work. Year after year, the use of these materials has grown because of their uniquely versatile characteristics. Lindsay continued to expand production. Now the rare earths are readily available *in quantities from a gram to a carload.*

Today the rare earths are extensively used in the production processes of a broad cross-section of the nation's chemical and manufacturing industries. For example: movie projectors, lighter flints, alloy steels, ceramic coloring, glass colorizing and decolorizing, polishing of glass, TV picture tubes and granite, welders' goggles, photosensitive glass, paint driers, nausea preventatives, reagent chemicals, petroleum cracking, aluminum and magnesium alloys.

During recent years there has been a surge of demand among technical men for the salts of some of the "rarer" rare earths in purities and quantities never commercially available. Three years ago, to meet the obvious industrial need for high purity material, Lindsay pioneered the first commercially installed rare earth ion exchange unit. Now more than 100 columns are in continuous operation, producing separated rare earths in purities up to 99.99%. Many of these are available for prompt shipment in quantities from a gram to hundreds of pounds.

### THORIUM COMPOUNDS, TOO

Lindsay's thorium, a close kin to the rare earths, once used primarily in the production of gas mantles, has come of age. You hear much about it as an atomic reactor fuel breeder. It has many other uses, too—in refractories, in the manufacture of "rare element" optical glass, jet engine castings, non-consumable welding electrodes and high temperature resistant metals for such uses as supersonic aircraft and satellite rockets.

Your research and process development people may already be studying thorium and rare earth salts, in relation to your own processes and products. We at Lindsay have a wealth of data which is available to them and we offer the technical assistance of our research staff.

May we remind you again that the rare earths are not rare; they are available in quantities from a gram to a carload.

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# RESEARCH BUILDS AMERICA'S FUTURE

## by RAYMOND STEVENS

*Arthur D. Little is one of the oldest and most distinguished industrial consultant firms in the country. Its president,* RAYMOND STEVENS, *who has been studying research problems of American industry since 1920, points to the new directions in which industry will develop in the decades ahead.*

By 2057, the world will have made technical advances far greater than those of the *Atlantic's* first hundred years, for science now progresses not in the linear fashion of Arabic numerals but logarithmically. As the steam engine and the electric motor brought about an industrial revolution with economic and social repercussions, so the products of current research promise a new renaissance, with its physical aspects overshadowed by great social change.

The first fruits of the new renaissance have been harvested. Man's basic needs for food, shelter, and health are met increasingly with the aid of technology. And science makes it easier, each day, to communicate throughout the social world — so much so that Jules Verne's once radical choice of eighty days seems almost incredibly quaint. Drudgery is under attack, and the next century may become known not as a second Age of Enlightenment, but an Age of Lightening of the burden of repetitive tasks, whether physical or mental.

The effects of research are felt in every corner of the world. Since knowledge is by definition power, the greater spread of scientific knowledge and method should give to all the peoples of the world a growing measure of control over their physical environment and their destinies.

### FOOD AND DRINK

The next generation will be better fed than any the world has ever known; this is the statement of a leading nutritional biochemist. By "better fed" he means that man will have a proper balance of proteins and the optimum supply of fats and carbohydrates and of vital organic compounds. No longer will pregnant cattle be privileged over humans in being given the special diets essential to the well-being of their offspring. Dangerous diets will be recognized and presumably avoided as a matter of course, but it is conceivable also that there will be less attention given to diets that will sustain life and more to those that will make life worth living.

Technologists have already made it possible to store food between seasons and to move it safely over long distances to market. South African rock lobster tails are no novelty in New York restaurants or supermarkets. Our present diet, in spite of what some carping critics say, is far more varied, more balanced, flavorful, and attractive than the food "mother used to make." The commercial and nutritive values of foodstuffs are matters for careful analysis throughout the food industry. Panels of trained students of flavor and odor in many food companies spend months studying a single food product — identifying its components and modifying them if necessary to assist the processors in improving both food value and sales appeal. The wide acceptance of dehydrated coffee and frozen concentrated orange juice shows what can be done.

One of the first objectives in food research was to preserve the flavor and nutritive value of foodstuffs for modern military needs. Dehydrated foods were prepared experimentally in World War I, but they were unappetizing, unattractive, and fairly low in nutritional value. Now, following techniques developed to meet military needs since the Second World War, we preserve foods by irradiation, by dehydration, by freezing, by anti-


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biotic treatment, and by combinations of these methods. By tying these procedures in with more orthodox approaches to processing, storage, and transportation of foodstuffs, the food industry will be able to offer in its products a fullness of flavor and nutritional value not now known.

Concurrently, new extensions of the food supply are being developed, often through a combination of technology and personal inspiration. The production of pineapples in Hawaii increased from cultivation of only 12 acres in 1901 to more than 73,000 acres in 1954. Partly, the increase followed the work of agronomists, who solved the problem of fertilization without hummingbirds, destroyed the ruinous nematodes with synthetic insecticides, and painted the leaves of the plants with iron for nutrition. But, as important as any step, James Dole sustained and directed the promotional effort that has made the pineapple and its juice available and popular in America today.

### CLOTHING

A few months ago, the research laboratory of a leading manufacturer produced a garment made completely from a liquid raw material. The garment, which had been sprayed on a form, was fibrous, flexible, and economical. It was presented as a potential throwaway item — one cheaper to replace than to launder.

The sheep and the cotton boll have not ceded place entirely to the test tube, but the manufacture of clothing depends less each year on the products of nature. The names of some of the synthetic fabrics are rapidly passing into the popular speech without public appreciation that they are registered trade names. The word *rayon* is so familiar that most consumers probably fail to realize that it identifies a man-made fabric, the result of the chemist's work with nature's cellulose. The products of research combine with natural fibers in fabrics that preserve the good qualities of both types and enhance the usefulness, performance, and appearance of the combinations.

If progress continues, the materials used in clothing will not involve the man-hours of labor traditional in the industry. The machines that make cloth operate today at speeds unheard of when Lowell was in its heyday, and they can produce better, more attractive, and far more diverse fabrics. The mass market for garments in any price range can be accommodated with ease, because engineering development of textile machinery has progressed so far.

Competitive developments in the field — not least of them the non-woven "sprayed-on" garment — imply further drastic change. Presumably the only area science will not have the temerity to attack is that of style!

### HOUSING

Ever since the days of Walter Gropius' Bauhaus, with its acceptance of the machine "as the essentially modern vehicle of form," there has been much closer association between architects and construction engineers. Technological advances, whether in materials of construction, appliances for comfort, or ease of assembly, are designed into homes and offices at the outset.

The modern urban house is still a monstrosity, however — probably less well adapted to the noise, dirt, and commotion of a large city than the homes of the great urban civilizations of the past. The wider use of year-round air conditioning — plus reasonable help from optical and acoustical technologists who have due regard for aesthetic values — presumably will mean the proliferation of homes completely independent of external climatic and noise conditions.

Not only in his home, but also at his place of business, man must operate effectively and in comfort. World War II stimulated new controlled studies of the psychological aspects of manufacturing operations. In all branches of industry, there are now more and more investigations in which physical chemists coöperate with psychologists, biologists with chemists, and physicists with meteorologists, in an integrated attack on the human problems involved in the production of goods. The possibilities are tremendous.

There will be ups and downs in the progress of housing technology, of course. The excesses of prefabrication to the stage of dreary uniformity must be guarded against. Flexibility can be built into the mass-produced house as new, cheap, and easy-to-handle materials change the builder's art. The present crude conversion of products from the forest and quarry will become obsolete, just as most of our structures even now are technologically obsolete.

### ELIMINATING DRUDGERY

What will be the effect of research-based industrial progress on the pattern of life in the next hundred years? It has long been known that technical changes in the basic industries — those providing food, shelter, and the essential amenities — will have a revolutionary effect on other industries. So far, these changes have been physical, with a high barrier between research work in the physical sciences and human activity. But the barrier has broken down, and the significance of the current integrated attack has only recently become apparent.



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In the scientific world, you don't know anything until you can measure it. "Nearly all the grandest discoveries of science are but the rewards of accurate measurement and patient, long-continued labor in the minute sifting of numerical results." So said Lord Kelvin around 1855.

Kelvin had in mind the physical sciences, and until recently his statement was thought to be applicable principally to them. But in recent years there has come a surge of quantitative analysis, measured experiment, and reconstruction in wide fields of human endeavor formerly considered outside the scope of so sophisticated an approach. The measurement of promotional results, the determination of optimum incentive practices, and the design of airplane controls for the best use of their operators' abilities are typical. A glimmer of possibilities appeared two generations ago, when Frederick Winslow Taylor, the engineer-father of scientific management, started the precise measurement of the time and motion of industrial workers. This was followed by an army of "efficiency engineers," who lost face when hosts of relatively incompetent enthusiasts climbed aboard and an efficiency engineer was stigmatized as one who was neither efficient nor an engineer. But then came the development of industrial engineering on a sound basis, and the well-trained industrial engineer is now fully accepted as a significant factor in industry.

During the Second World War operational analysis, or operations research, made an advance comparable only to Taylor's. It was found that physicists, physical chemists, mathematicians, and specialists from other disciplines previously considered far outside the practical world of commerce and industry were able to make major contributions to complex problem solving. A new sophistication came into the analysis and handling of vast amounts of data in complicated situations, first military, then industrial.

As this trend continues, management will become less and less a matter of simple judgment based on experience and native ability; it will become increasingly professional. And integrated with it will be professionals with advanced education and training in the sciences — physical sciences, engineering, psychology, mathematics, and their many branches. The barrier between the professional engineer or scientist and management has disappeared in many of the most successful growth industries — this may even be one reason they are growing industries — and this type of increased sophistication is spreading.

The pure scientist investigates basic laws and creates generalized concepts. Then follows imaginative application of the new knowledge by applied scientists and engineers through trial, experiment, modification, retrial, and more experiment, to achieve practical results — new sources of comfort, convenience, health, and well-being. The methods involved in this pattern of research and development were first applied only in a narrow field of technically oriented industries. But now, as more of the total range of human endeavor is opened to measurement and control, the methods and philosophy find widespread application. We may expect in all industries the same refinement in method and practice that is now taken for granted in many phases of the chemical industry, which first benefited from this new thinking and practice.

## AUTOMATION

Curious and unpredictable reversals can be assumed. One is already apparent: the "laboring man" and the "white collar worker" may exchange their relative social and economic status and community acceptance. Curiously, this is in part the direct result of automation. Instead of hundreds of Charlie Chaplins wielding wrenches on successively numbered nuts and bolts, highly intelligent, highly trained, highly paid "laborers" direct the operations of expensive, complicated, automatic equipment.

An example appears in the chemical industry, where an output worth many thousands of dollars a day is controlled by a few intelligent, thoroughly trained technologists with short hours, little drudgery, and high standing in the community. It is at least possible that the ancient institution of the craftsman will return, and that once again intelligence, long apprenticeship, and intellectual interest in their craft will characterize industrial workers. Drudgery can be left, by more intelligent selection methods, to those more adaptable to it by limited ability, temperament, or actual preference — or to machines. With the continued integration of science and industry, the term *industry* itself should broaden its scope, with less distinction, for example, between production and services and between agriculture and manufacturing. The pattern of "working for a living" will become more uniform — at least to the extent of raising even the more menial tasks, through automation, to a socially acceptable level.

As the standard of living rises, we can expect a corollary increase in the service industries that cater to the requirements of leisure or help sustain basic production in a variety of ways. There are already more television repairmen than television salesmen; there are more clerical workers for the oil companies than there are drilling crewmen.

Even the service industries benefit from automation. Much of Bob Cratchit's work has been



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given over to the adding machine; in terms of time saved, Scrooge could afford to give him a whole day off for Christmas. But today's merchants, operating on a scale not even hinted at by the Ghost of Christmas Yet to Come, require masses of figures on almost every conceivable type of operation.

### THE CLERICAL REVOLUTION

Transportation, financing, merchandising, and many other industries are increasingly susceptible to automation. Their own brand of renaissance, the clerical revolution, has begun. One of our largest banking institutions treats the money in its branches as an inventory problem; mathematics is invoked to determine the optimum quantity needed to service customers while keeping a minimum of expensively idle cash on hand. A bus company uses mathematicians to determine the most efficient utilization of its fleets. A large advertiser makes a quantitative study of the impact of his promotion of new items. These and other current projects give earnest of future business practices so sophisticated that by comparison present industry will seem as crude as the cave man's club.

Much of this development will follow growth in machine size and complexity. The adding machine, which cannot compete with the abacus for speed, is a simple toy compared with the powerful "giant brains" of today. Whether working with actual numbers, as do the digital computers, or representative quantities, as do the analog computers, electronic calculating equipment is now being applied to the most diverse problems of both science and industry. A major aim is to save time — clerical time and drudgery — but also the machine designers look to providing more and better information more accurately than a clerk can. And the application of machine control to complex manufacturing processes, from an incoming order through the scheduling of production, controlling quality, and billing out, is only the beginning.

But of course no machine is smarter than the man who runs it, and it is only the trivial and repetitive, time-consuming operations that are fully relegated to these new brain-supplementers. A high order of intelligence is required of the operators who instruct the machines to perform their appointed tasks and who interpret the results for the benefit of industrial and social growth.

### WHAT OF THE FUTURE?

Certainly the welding of science to industry and the development of new products and processes through research will continue to shape the industrial pattern. But one of the most satisfying trends is that toward the emphasis on human values and an awareness of their significance to profits. Taking this trend into account, we can look for changes in the pattern of the last century — changes that will affect regional life, educational opportunity, and the chance for the individual to fill up his growing leisure in a positive way.

### GENIUS

The body of human knowledge is vast. A civilization based on the proper application of physics, chemistry, biology, mathematics, psychology, and economics requires a supply of citizens competent to carry out activities in a manner far more sophisticated than was needed in the simpler civilizations that have preceded us. The level of performance required of the nonexistent "average man" is high; that of the genius must obviously be so much the higher.

The best of the "liberal" colleges are giving more adequate attention to disciplines useful in applied research and eventually in commercial and industrial operations. At the same time, the best of the science and engineering schools are giving far more than lip service to a proper balance between science or engineering and the humanities. The common aim is a more suitable education for future living. But the threats are from outside the industrial laboratory, the factory, the store, or the office. Whether advances in the study of human relations and motivations can be integrated with technological progress and whether an educational program can offset inherited or transmitted selfishness, instinct for power, and jealousy, are quite obviously open to question. But it seems unlikely that current advances will give way to another protracted dark age of open antagonism, want, and misery.

Leadership in the new renaissance may be partly the result of planning. For example, at least two large American companies have organized staffs to attack the problem of more efficient utilization of their technical personnel. In its simplest terms, this means the elimination of waste effort, keeping technical men on assignments at their highest level of competence, and relieving them of work that can be done by less able, less brilliant, or less highly trained associates, or by machines. If this work continues, if it grows in scope to match a large increase of population, a better knowledge of nutrition and general health, and a more enthusiastic effort to discover, encourage, and develop brilliant youth, then more than one Einstein may appear in the next century as a direct outgrowth of the present activity in applied science.



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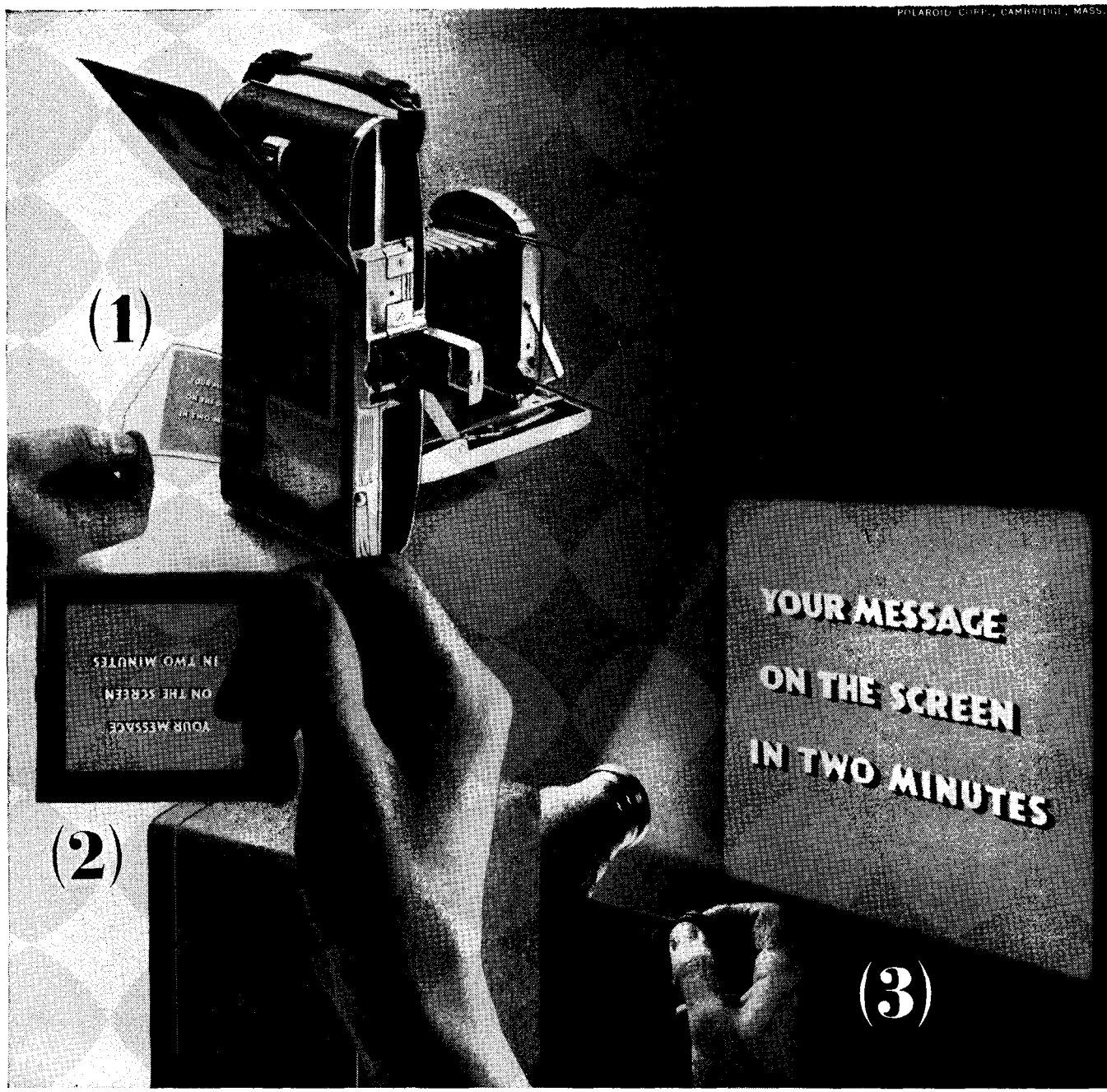


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# TIME AND THE SPACE TRAVELER

## TWO VIEWS

EUGEN SÄNGER — WILLIAM R. BREWSTER, JR.

Not the least devastating effect of Hiroshima was the instantaneous transformation of $E = mc^2$ from a remote bit of theoretical physics to a reality with terrifying implications for every human being. But the mass-energy relationship used for atomic fission is only one part of Dr. Einstein's theories. For most non-scientists, much of the remainder is still so fantastic that we think of it, if at all, as a series of scientific allegories, as remote from ourselves as medieval arguments over how many angels could balance on the head of a pin.

Certainly Einstein's theory that time and space shrink when measured within objects moving at great speed challenges our common sense. We know, or think we know, that an hour is an hour and a mile is a mile. Yet consider two facts. Laboratory experiments with particles moving at very high speed have already shown the shrinkage in time measurements that Einstein predicted, while according to press reports the Air Force has let two contracts for the study of photon (light particle) propulsion. A photon propulsion system would use the force of a beam of light emitted from the rear of a vehicle to propel the vehicle through space at a speed approaching that of light itself. The engineering problems are tremendous. Yet the principle is reported to have been successfully demonstrated in the laboratory.

Suppose man someday succeeds in building such a propulsion system. The two articles that follow consider the problems involved from two viewpoints. Dr. Eugen Sänger, Director of the Research Institute for Physics of Jet Propulsion, Stuttgart, Germany, discusses what Einstein's shrinkage of time might mean in terms of human exploration across the great distances that separate our solar system from the nearest stars. William R. Brewster, Jr., and his colleagues of the Anesthesia Laboratory of the Harvard Medical School take issue with Dr. Sänger's interpretation of Einstein's theory and raise the question of what effect space travel might have on the physical structure of human beings. — The Editor

## REACHING FOR THE STARS

by EUGEN SÄNGER

To achieve new living space for men will require an immense leap forward from interplanetary flight to interstellar flight that may bring us to other solar systems within our galaxy. Here, in these remote systems, many astrophysicists hope to find planets, and among them planets similar to our own earth.

Today interplanetary space flight is only at the very rudimentary stage of its technical development. This means that the investigation of such power-plant systems as the ion rockets and photon rockets is also in a very early stage.

Photon rockets are the ultimate development of jet propulsion. Their exhaust velocities attain the extreme physically possible limit, the velocity of light. At this point, flight speed in the technical sense becomes in effect limitless because of the relativistic phenomena that appear when the velocity of light is approached.



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It is clear that rocket propulsion will play the decisive part in space flight. In view of the immense distances to be covered, fuel consumption will be the decisive factor in the ultimate choice among the different rocket systems.

In jet propulsion, we do not measure fuel consumption by such performance units as horsepower-hours, but by impulsion units, such as ton-seconds. Ton-seconds (abbreviated "secton") are the product of the thrust, in tons, of a jet power plant multiplied by the duration, in seconds, of this thrust.

A very modest fuel consumption — only 33 milligrams per secton — will enable space vehicles propelled by photon rockets to extend the duration of powered flight over years. Flight acceleration will be comparable to that produced by terrestrial gravity — that is, about 10 m/sec$^2$. This means that on the one hand the crew will be able to live under the same gravity conditions that they are accustomed to on earth, and on the other hand the final velocities of the space vehicle, relative to earth, will come very close to the velocity of light.

Space vehicles of this kind can, therefore, aim for destinations outside our solar system — fixed stars within our galaxy or even stars of other galaxies. Thus we shall enter the age of interstellar or even intergalactic space flight.

For such space travels, we have to consider the special laws of the theory of relativity. These can create very peculiar situations, as can easily be shown by a practical example.

Let us suppose that such a vehicle starts from a space station near our earth toward a star about 1000 light-years away. For the better comfort of the passengers, the space vehicle would be accelerated only at a constant rate of 10 m/sec$^2$ — that is, as measured by the instruments on board and according to the physiological effect on the travelers. During the flight the crew would keep the telescope sight of their navigating instruments aimed at their destination star. Due to the Doppler effect, the original color of the star — say yellow — will appear to the crew to change gradually to green, blue, violet, and so on as the speed of the spaceship increases. Finally, the radiation of the star will become invisible to human eyes in the ultraviolet range of the spectrum, so that from now on the vehicle can be kept on the right heading only by instruments. It is by means of this Doppler-effect shift that the crew will be able to tell after 1.4 years of flight that they are approaching their destination with a velocity 90 per cent of that of light.

As rocket propulsion continues to accelerate the ship, after the crew has measured the passage of 5.6 years they will find themselves speeding toward their destination with 99.999 per cent of light velocity. The light of the destination star will have meanwhile apparently changed its wave length from its original 5900 Ångstrom units to 11 Ångstrom units, thus becoming X radiation.

If the crew were now able to measure the distance between their vehicle and the destination star, they would find a value of about 5.5 light-years instead of about 994 light-years, as you would ordinarily expect when you have traveled 5.6 light-years out of a total distance of 1000 light-years.

This enormous discrepancy is due to the fact that the velocity of the vehicle relative to earth and to the destination star is now nearly that of light. As a result, the distance between earth and star is submitted to a relativistic change of length. It appears for the crew of the vehicle to be substantially diminished, in this case to less than a two-hundredth of its astronomic value.

Even without further acceleration our vehicle would reach its destination star after 5.5 years more — that is, after a total flight duration of only about 11 years.

But while the crew has spent some 11 years aboard, according to the accurate indication of their own chronometers, the human observers left behind on earth see more than 1000 years pass away according to their equally accurate watches. The two measurements of time have undergone a change in relation to each other, just as the two distance measurements, as figured on the earth and aboard the spaceship, have become different.

If the crew of the space vehicle were able to watch events on the surface of the destination star during their trip, at the start they would see conditions on the star as they existed 1000 years before. Then as the space vehicle accelerated, the history of the destination star in the previous 1000 years would roll off before their eyes as in a speeded-up motion picture. When the crew arrived at the destination star after 11 years' travel (according to their own measurement of time), they would consider things they find happening on the star as occurring in "present" time. Thus the crew would have observed the events of more than 1000 years within a period of only 11 years — that is, almost 100 times as fast as an inhabitant of the destination star itself would have observed them.

If the crew should stay for some time on the destination planet, they would observe events back on the earth happening in their proper rhythm but as they occurred about 1000 years earlier relative to the actual time of the crew. On the other hand, if the crew of the space vehicle should return to earth immediately after their arrival on the destination planet and should com-



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plete their return journey in exactly the same manner as their outward-bound trip, they would be another 11 years on the way, while another 1000 years would slip away on earth. Landing the space vehicle on earth after 22 years of travel, the crew would find that earth had become about 2000 years older.

Relativistic phenomena generally cause a lot of intellectual difficulties for the non-scientist. This is especially true of the concept of time on board a space vehicle that is traveling nearly at the speed of light — time that seems far longer to the observer on earth than to the traveler.

These intellectual difficulties are partially due to the fact that here we are dealing with events far outside the range of our usual daily experience. We must get used to them in the same way that we have learned to accept other initially inconceivable things like radio, television, and human flight.

Partly, however, these difficulties are based on a substantial misconception that many people have: the idea that these apparent differences in time occur because something happens to slow up the instruments and the biological life rhythm of the crew. In reality neither the rate at which the crew ages nor the speed of the chronometers changes in the slightest. The extension of time is nothing else than an observation phenomenon just for the terrestrial observer. This phenomenon may be quite different for any other observer perceiving the same space vehicle from a point other than earth — say from a very fast-moving planet. If our crew never has a chance to communicate with their native planet during the flight, they will never become conscious of any extension of time but only perceive the shrinking of distances as a reality.

The mechanical reality of this relativistic extension of time was first measured in laboratory experiments almost 20 years ago by means of the so-called square Doppler effect. The outcome of these experiments, as well as of later measurements of cosmic-ray particles with velocity close to that of light, corresponded exactly to the Einstein theory. As a result, the special theory of relativity is today as firm a basis for interstellar space travel as Newtonian mechanics is for the earth satellite or for interplanetary travel.

There are two striking consequences.

First, it is possible in principle for individuals to cover any astronomic distance of the universe within their limited lifetime. Traveling speeds can increase without limit, if they are calculated by comparing the astronomic distances as they are measured on earth and the times as they are measured on board a spaceship. A photon particle with the velocity of light could thus travel infinitely fast. As a result, human beings will be able to reach remote stars, thousands of light-years away, within their own lifetime. It will not be necessary to man spacecraft with miniature communities that perpetuate themselves through generation after generation of new individuals that are born, grow up, and die flashing across space until at last far descendants of the original crew reach the destination.

Second, the fuel consumption which is needed for these immense velocities is, relatively, remarkably low. Even so, the absolute value of this fuel consumption is still high. For instance, the initial gross weight of a spaceship able to approach 99.999 per cent of light velocity would have to be 447 times its final weight at its landing point. Nevertheless, this ratio appears to be technologically feasible as astronautical engineering develops.

Far more uncertain, on the other hand, are the technical details of how the photon power plants will be achieved. Today we can only speculate that the photon jet will probably appear to the crew as ultraviolet rays and will be generated by hot metallic vapors. This part of the power plant will be analogous to present-day mercury vapor lamps, but the metallic vapors — or, better, metallic plasmas — may have temperatures of as much as 150,000 degrees Kelvin temperature.

These bright metallic plasmas would form an integral part of the power plant and would be heated by the energy produced by the propellants. This energy in its turn is liberated by more or less complete transformation of matter into energy. This is already done with increasing perfection by today's nuclear techniques.

Man's eternal reaching for the stars may yet succeed. The infinite universe will open to us, open to its ultimate boundaries.

## THE PARADOX OF MOTION

by WILLIAM R. BREWSTER, JR.

Laws pertaining to life processes in space must be developed in anticipation of the time when we will possess sufficient knowledge of the laws of the universe to predict both the course of man's travel in interstellar space and the effect of an alteration of the environment on his biological structure and function. At present we do not understand completely the laws of life or the laws determining the behavior of a particle, body, or energy quantum in space. There is hope, however, that a more thorough understanding of



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electromagnetic and gravitational influence upon orbital bodies might result in a better knowledge of energy transfer in the minute universe of the living molecule.

What influence will be exerted on the rate of energy transfer in the human body when it is subjected to uniform motion relative to the earth? The answer is none whatsoever. Not only science-fiction writers who are eager to entice the public with the bizarre, but many teachers of college physics, have stated that men who travel away from the earth at a given high velocity relative to the velocity of the earth will experience physical shortening in the direction of motion and a slowing of their life processes, causing them to return to the earth at a less advanced stage of life than they would have been in had they stayed home.

The fallacy of this notion is found on reconsidering Einstein's two basic principles in his special theory of relativity: 1) The velocity of light is constant to all observers regardless of its source. 2) An observer cannot detect uniform motion of his own system.

Concerning the latter first: One can measure his velocity only in relation to another object. The earth-bound brother considers himself at rest (and we remember to exclude all consideration of acceleration and gravity, confining our description to uniform motion only). He sees the brother in the spaceship whizzing past. He observes that his brother's dimensions are contracted, according to the FitzGerald-Lorentz contraction equations. He observes his brother's clock to be running slow, and his brother's heart beats, like the clock, are observed to be slow.

But the value of the (v) — velocity — is not absolute; it is relative, and Einstein says that the two frames of reference may be interchanged and the calculation that was true for one system of reference will hold true for the other. So the brother in the spaceship, since he is moving uniformly and therefore cannot detect his own motion, may assume his ship to be at rest. He sees the earth whiz past. The objects on earth are observed by him to be contracted, according to the above equation; his brother's clock is observed to be slow, and his brother's heart is observed to be beating with the rate of a hibernating animal. But that brother did not "go" anywhere. So we see that when two moving systems are considered, space brother is slowed and shortened in earth brother's observation, while earth brother is slowed and shortened according to space brother's observation.

If space brother's life had slowed in comparison to its *previous rate* (or to what it would be were he still on earth), then he, from his spaceship, must observe earth brother as getting older faster than himself, his clock running faster, and his dimensions proportionately larger. To believe this is to defy the structure that Einstein has built. The value of (v) must apply to either system, depending on which one is chosen for the frame of reference. If the advocates of the Sleeping Beauty twin apply the FitzGerald-Lorentz contraction law to the space brother, they are right when the earth is used as the frame of reference, as long as they apply the same law to the earth brother using the spaceship as the frame of reference. While he is traveling through space, and is being considered on earth as hibernating, he is calculating that those on earth are hibernating and he is the one who is getting older. When he arrives home, he and his brother will have a most engaging discussion over which one is the older!

Why, then, does this FitzGerald-Lorentz contraction appear to produce a paradox? Einstein's other basic assumption is that the velocity of light is constant. That is, light waves must traverse $2.998 \times 10^5$ km/sec from every frame of reference no matter how it moves relative to another body. Though the number of km/sec is constant, the value of the km and the sec is flexible and cannot be determined except in terms of a given frame of reference. In the same way, the man whose heart beats 72 times a minute will continue to count 72 in each minute *by his clock* regardless of how he moves relative to another body, since there is no way to detect uniform motion of one's own system.

If earth brother determines the heart rate of space brother to be, say, 40/min., he is counting 40 beats to his own earth minute, which is now different from his traveling brother's minute. Space brother will still count 72 beats for each minute on his own watch, but the length of the minute in the spaceship can never be synchronized with the minute on earth. The tick of the clock and the beats of the heart on one moving system occur farther apart in *distance* to the observer who is aware of their motion and, since Einstein has shown us that space is a function of time, the time *interval* is longer to that observer. The FitzGerald-Lorentz contraction, then, fills the purpose of adjusting the geometry of space and time to each moving system, reconciling the observed discrepancies in measurement between two moving bodies.

Therefore, I propose that the energy transfer process which we call life can be considered constant within a frame of reference which is moving relatively to another body at any uniform velocity. This consideration, however, is a hypothetical one, since the Einstein theory is concerned with uniform motion only and not with the effects of acceleration, gravity, and inertia.



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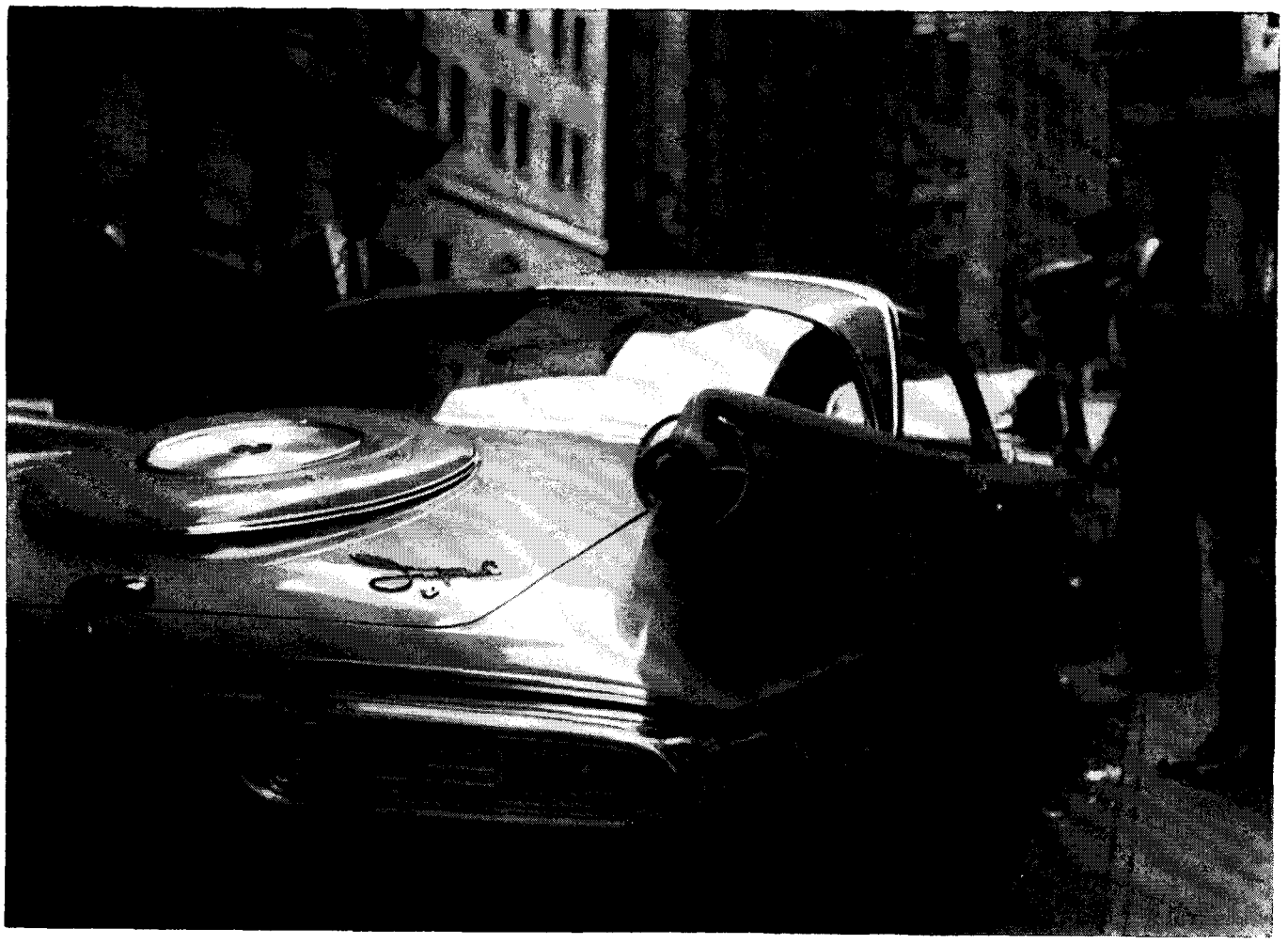

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In dealing with the effect of uniform velocity upon the living system, we see immediately that the process of life and its characteristics will not be altered as a function of uniform velocity per se. This consideration alone, however interesting, still leaves untouched many formidable problems: the nature of life, its properties, and the conditions required for its existence.

Recent work in many laboratories has demonstrated that life in description is not as vague as it might seem. In structure, it is the grouping of thousands of different kinds of ions and molecules. In function, this structure is able to capture, store, transfer, and utilize the energy of quanta of light photons to maintain the internal energy of its system at average levels where free energy may be dissipated as work. This dissipation of free energy and the incidental performance of work are responsible for varied processes, such as the contraction of heart muscle, the moving of ions by the kidney, and nerve impulse transmission. The living system is essentially an "open" thermodynamic system in which the cells are capable of exchanging energy with outside sources. More information is needed concerning the rate at which energy is stored and expended. Biological optima of temperature and pressure play a key role in this respect and clearly determine the rate of performance of work.

We know from the data of divers that an increase in pressure of one atmosphere is tolerated for only a few hours. Data from man and laboratory animals indicate that there is limited survival when the atmospheric pressure is reduced by one half. Survival is limited to a few weeks with or without an increased oxygen concentration in the atmosphere.

There exists the possibility that life on earth has built-in constants which must be maintained for at least optimal performance, if not survival. These constants include a gravitational field, an electromagnetic field, and the energy of the photon. Evidence of these constants may well be seen in the spin of orbital electrons, the activated states of orbital electrons, the selection of the living organism of molecules which specifically rotate a plane of polarized light to the left, and the alpha helix structure of fibrous proteins. Evidence is accumulating to suggest that the biosphere has its own specificity for spin and moment which may well be critical.

The photons emanating from the sun, both in their frequency and incident intensity, are responsible for the existence of life on earth. We have read much concerning the constancy of the velocity of photons, little about their influence as a flux upon the field of forces about earth. How greatly will the dissipated flux energy affect a body moving through the resistance of a photon flux? What fields of forces will result? What will determine the energy imparted to a body moving through a flux and to the occupants or inhabitants of this body? An answer to these questions may well be essential in our search for conditions necessary to survival of life in "space."

What will happen to man, who has evolved on earth, when his surrounding fields are altered? What will happen to the various living energy systems, vectored to contend with earth's phenomena? Is there a minimum field necessary for man's existence? If so, we must design a space vehicle that will be consistent with man's need for the constants required for survival.

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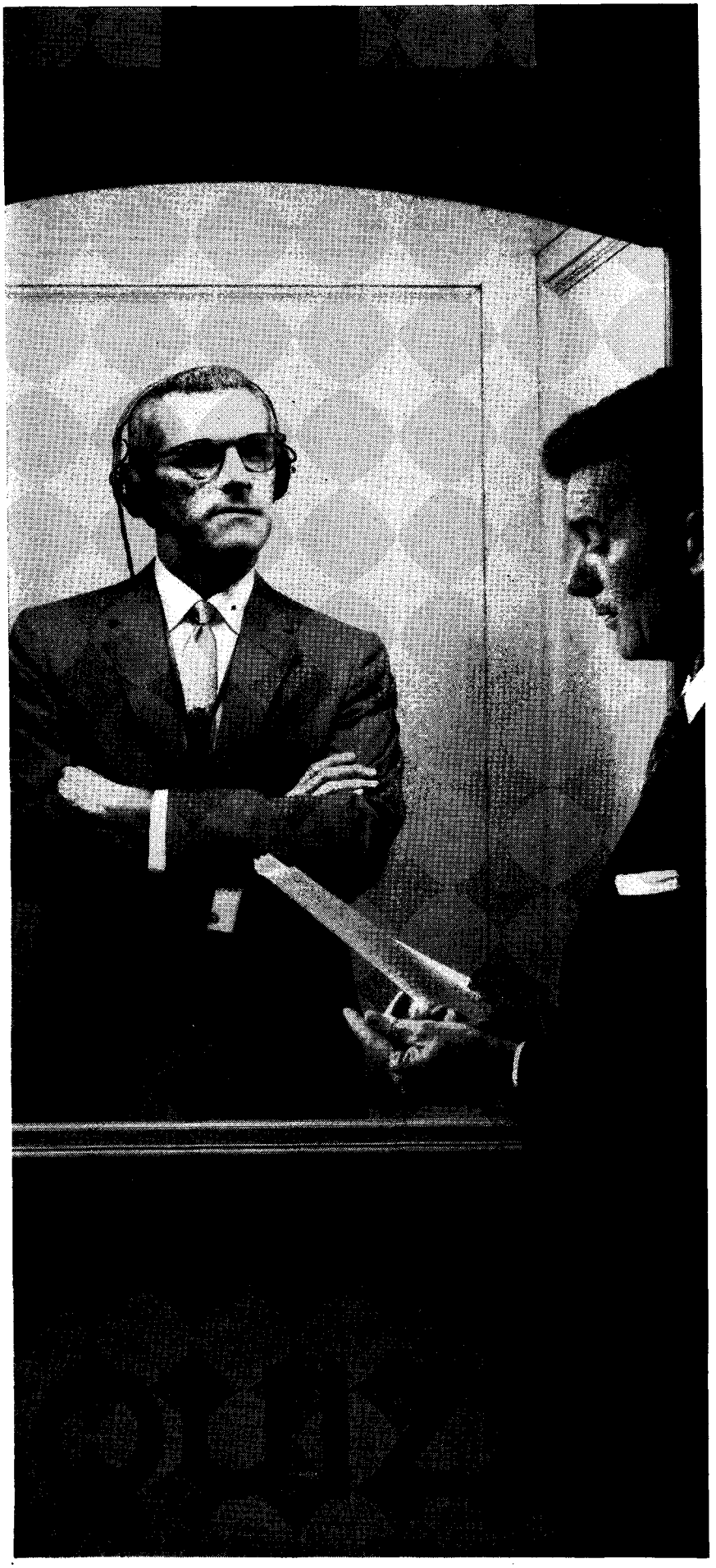

# Can you answer these questions about taxes?

**Q: Do you pay taxes in your electric bill?**

**A:** Yes. In fact, about 23¢ out of every dollar on the average family electric bill goes for taxes.

**Q: Does everyone pay this much tax in his electric bill?**

**A:** No. Several million American families and businesses pay a far smaller tax—only a fraction of the tax you and most people pay.

**Q: Who are these "privileged" people?**

**A:** People who get electricity from federal government electric systems.

**Q: Why don't they pay the same taxes *you* pay?**

**A:** A strange twist in federal law exempts them from paying most of the taxes in electric bills that you pay *because they get their electricity from federal electric systems.*

**Q: Isn't that unfair? Shouldn't every American pay his fair share of taxes?**

**A:** Yes. American standards of fair play call for each citizen to pay his fair share of taxes.

America's Independent Electric Light and Power Companies*

*Company names on request through this magazine

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# KEEPING HOUSE IN OUTER SPACE

## by HARTLEY E. HOWE

THE engineering problems in designing a vehicle and a power plant to carry men into space are formidable. They are matched by the problems involved in what might be called the housekeeping aspects of space travel.

To keep the crew of a spaceship fed and in good physical and mental health will require the development of wholly new techniques in many fields. This is particularly true of vehicles that are to make long voyages to other planets — or to leave our solar system entirely.

WEIGHTLESSNESS. Whenever the propulsion system is turned off, the crew and everything else aboard the space vehicle will be completely without weight. Although individuals have undergone very short periods of gravity loss without apparent ill effects, we still know very little about what this phenomenon will mean in space travel. Certainly many common movements will become difficult. Gravity plays a considerable part in the mechanism by which the individual perceives his body's position in space. With gravity removed, the eyes will have to take over this function.

OXYGEN SUPPLY. Every crewman will require 500 liters of oxygen every 24 hours — too much to be carried on any but the shortest trips. Since plants release oxygen, one answer might be to carry along a batch of the tiny water-borne plants called algae: 2.3 kilograms of *Alga Chlorella pyrenoidosa* produce enough oxygen to supply one man. Plants require light energy for carrying out their metabolic processes, however; so artificial sources of radiant energy will have to be carried aboard the vehicle for flights outside the solar system. This presumably will increase the demand on the vehicle's power plant.

CARBON DIOXIDE DISPOSAL. With every breath man expels carbon dioxide, which must be removed from the air within the vehicle. Since plants consume carbon dioxide, the same algae might take care of this problem.

WATER VAPOR CONTROL. The crew will also release considerable water into the atmosphere of the vehicle through their perspiration and breath. A humidity control system will be needed to keep the vapor content of the air within the limits of comfort.

WASTE PRODUCT DISPOSAL. The vehicle will be sealed so nothing can be expelled. Human wastes will have to be treated by bacteria in a closed sewage system.

WATER SUPPLY. Water used for human or other purposes on the ship will have to be recovered, cleaned, and reused over and over again.

FOOD. For a space voyage of any length the crew will have to produce their own food as they go along. Here again the useful little algae offer one solution. The same *Chlorella pyrenoidosa* is highly nutritious and can be made to produce either a high concentration of fats or a high concentration of protein.

TEMPERATURE CONTROL. The cold in outer space will be intense, particularly outside of the solar system. An insulation system of extreme efficiency will be needed to minimize loss of heat through the vehicle's shell. Probably double hulls, one within the other, will be required. Whatever heat is lost will have to be replaced by a heating system.

LIGHT. Traveling within the solar system but outside the earth's atmosphere, the crew will find everything in sunlight cruelly bright, everything in shadow in inky darkness. The sharp contrast will present visual adaptation problems to space travelers. At the same time they will have to be careful to avoid looking directly at the sun for fear of retinal burn, since the sun is far more dangerous when not filtered through the atmosphere. All observation ports will have to be equipped with light filters.

DAY-NIGHT CYCLE. Since there will be no normal succession of day and night, the crew will have to adjust to an artificial cycle for work, recreation, and sleep. Laboratory experiments have shown that the body can adapt to a cycle ranging from 18 to 28 hours.

COMPANIONSHIP. Choosing and matching the individuals who will make up the space crews, which will be completely isolated from all other human contact for months or years, will be a vital problem. Studies made by the armed forces for selecting men for isolated outposts give some clues to possible approaches. Groups of two have been found to develop extreme friction. Groups of four or more tend to break up into two groups and again friction develops. Three-person units are considered preferable since each individual is considerate of the others lest they combine against him. Space crews might be broken up into three groups of three individuals with rotation of individuals from group to group.



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# NEW DEVELOPMENTS

## RADAR

As aircraft and guided missiles go faster and faster, our warning system must detect an approaching enemy at ever greater distances if there is to be time for countermeasures. That means longer range for our radar. One way to achieve this is to increase the power of the radar signal.

A new radar tube brought out this year by Raytheon, called the amplitron, increases the energy output of the basic signal eight to fourteen times. The amplitron has a peak power equal to that needed to light a city of 200,000 people, but is only one quarter as big as earlier tubes producing the same signal power and requires less than half the voltage. Its comparatively small size and light weight make it possible to develop special purpose radars to be carried by planes and missiles.

Boosting power presents great problems to the radar engineer. Doubling the range at which an aircraft can be spotted takes sixteen times the signal strength. To multiply the range by 10, the power would have to be multiplied by 10,000. That is why a new device developed at Columbia University is described by experts as the greatest advance in radar since the start of World War II: it increases the effective range of a radar set to an unprecedentedly high level without increasing the power demand.

Called "signal enhancement," the Columbia system improves both the signal and its reception. A unique transmitter sends a carefully controlled signal with characteristics that make it easy to identify when it is bounced back off the target. At the receiver, an echo so weak that it would be lost in static in the ordinary radar receiver is made to "stand still" momentarily. The receiver can then separate it from the atmospheric static and use it to determine the distance and direction of the target.

The degree of improvement in range thus achieved has not been revealed, but the device is described by Dean John R. Dunning of the

Here at ADL versatility is a vital factor in professional accomplishment. In this, one of the world's oldest and largest industrial research organizations, it is commonplace for staff members — chemists, physicists, biologists, engineers, mathematicians, technical economists — to reach outside their usual fields in solving problems for business, industry and government.

The diversity of ADL's work — from solar furnaces to investment advice; from new products to inventory controls; from regional development counsel to computer design — reflects the versatility of the ADL staff.

Whatever your scientific field or your outside interests (are you a mathematician with a flair for botany? . . . a physical chemist with a background in the humanities? . . . an electrical engineer with a bent for economics?) perhaps you have a valuable combination of talents that could bring new ideas to ADL in work that would be more satisfying to you.

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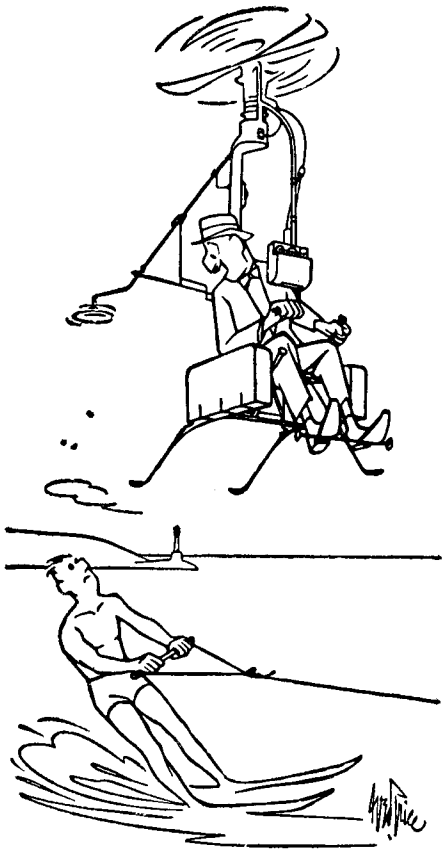

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Columbia School of Engineering as "a first-rate breakthrough that seems to alter the entire concept of how we are going to communicate over long distances and out in space." It not only increases the distance at which an enemy vehicle or missile can be detected, but its greater sensitivity makes it possible to pick up weak echoes from jet aircraft and guided missiles, which are much poorer reflectors of radar than older types of aircraft.

COMPUTERS

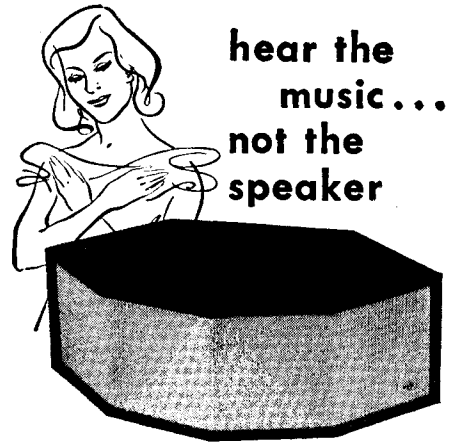
A special computer just announced by Ramo-Woolridge is designed to take over completely the operation of any continuous-process plant. When all the variables are fed into it, the computer element determines the proper output signals needed to control the process. It is intended specifically for oil refining, chemical processing, distillation, or any other continuous industrial operation.

Meanwhile M.I.T. engineers are studying the role of the computer in making management decisions. Financed by a Ford Foundation grant, the School of Industrial Management is experimenting with an I.B.M. computer to see if it can coördinate all the varied bits of information now divided up in separate departments of a big industrial concern. The M.I.T. researchers simulate the flow of such data as the availability of capital and raw materials, the movement of partly finished products from division to division, sales demand, competitive activities, and new processes. They hope to learn how to program the computer so it can juggle all this mass of information and come up with an analysis of its effect on the company.

HEART TROUBLE

The exact relation between a high level of the fat-like substance called cholesterol in the blood stream and the occurrence of heart attacks is still not entirely clear. But heart researchers all over the world think it worth while to study the effects of various factors on cholesterol levels.

Now Pfizer has developed a drug specifically designed to lower the cholesterol level in cardiovascular patients. Paradoxically, the new blood-fat fighter is a fat itself — an essential fatty acid called lineolic acid. It is combined with the vitamin




**JansZen** *Electrostatic*

It is interesting to note that women are more sensitive than men to overtones in the higher ranges. If your present music system includes a dynamic tweeter, the resultant distortion of these overtones may well be the cause of your wife's complaints about the "shrillness" or "loudness" of your music system. The fact that the JansZen lets you hear the music and not the speaker, eliminating exaggerated and distorted highs, solves the problem for the sensitive listener.

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pyridoxine in an emulsion that the manufacturer has named Linodoxine.

Used experimentally on patients suffering from cardiovascular disease as well as on others who showed no signs of such disease, Linodoxine lowered the blood cholesterol level in nearly every case. The percentage drop was sharper in those who were suffering from angina (impeded flow of blood through the coronary arteries) or who had experienced blockage of a coronary artery, such as the one that President Eisenhower had in the fall of 1955. When the medication was stopped for two or three days, cholesterol levels promptly rose.

SAFTI-FLIGHT TIRE

The sensitive independent suspension systems of the front wheels of modern cars make it a tricky business to keep these wheels in balance, and periodical readjustment is usually necessary. The Fisk company claims that its new Safti-Flight tire is permanently balanced by a thin strip of dense rubber vulcanized completely around the inside of the casing. The manufacturer says the tire will not vibrate even at high speed, and will give longer tread wear, easier steering, and a quicter ride.

MORE MILK PER ACRE

Farm scientists at the University of Rhode Island have found that you get more milk per acre when you take the grass to the cows than when you take the cows to the grass. Using a technique called soilage, or zero pasture, they cut the grass in the pasture twice a day, chop it up, and carry it to the cows in a feed lot. Zero pasture eliminates losses of forage caused by trampling, plant selectivity, and manure droppings.

The farmer must spend over two hours a day in mowing, chopping, and hauling grass for the cows; but in the three-year test, the soilage group produced over 40 per cent more milk per acre than pasture-fed cows did.

SPROUTING SEEDS

Scientists at Washington State College are bombarding hard-shelled seeds like sugar peas and alfalfa with high-frequency waves. The radio-cracked seeds sprout faster and the plants all mature at the same time.


**ROCKET POWER PROGRESS REPORT**

# Achieving Rocket Reliability

*by Bernard Tiger*

*Currently investigating new concepts in the design and demonstration of rocket engine reliability, Mr. Tiger is a senior engineer in the Systems Department, Component Development Division at Reaction Motors, Inc. Prior to joining the company in 1956, he taught communications electronics and was a consulting electronics engineer. Mr. Tiger received his B.S. in Mathematics and Statistics from Brooklyn College and is now engaged in postgraduate work in Applied Statistics at Stevens Institute.*

Before a rocket is fired, there must be a high probability (i.e. reliability) that the rocket will successfully accomplish its mission. The expense and potential destruction is too great to needlessly risk unsuccessful firings.

As a result, the science of Reliability Engineering has been applied. It specifically deals with:

(1) the design and development of reliable rocket systems, and
(2) the determination of test procedures to demonstrate this reliability.

This article will briefly describe some of the factors that RMI has found important in the design and development of reliable rocket power systems. They include:

(1) *Component Homogeneity:* Production components must be as identical as possible with each other and with those that undergo reliability testing. Design and development engineers should keep in mind the necessity of developing prototypes that can be mass produced with a minimum of variability.
(2) *Simplicity:* Design and construction should be such that the number of parts necessary for successful operation is minimized.
(3) *Use of Proven Parts:* Fully developed and time tested parts should be used wherever possible.
(4) *Determination of Environmental Stresses:* Maximum "stress" levels (temperatures, altitude, vibration, etc.) to which the rocket may be subjected must be carefully determined. If any specified "stress" level is estimated too low, the rocket may be doomed to failure.
(5) *Elimination of All Possible Causes of Failure:* All possible causes of failure that may be encountered during the rocket's life cycle should be recognized and eliminated. Design solutions should apply to the mass produced part as well as to the prototype.
(6) *Reduction of Severe Operating Requirements:* The effect of severe operating requirements should be minimized wherever possible. For example, if a part cannot be built ruggedly enough to withstand the effects of vibration, the part may be shock-mounted.
(7) *Statistical Quality Control and Acceptance Testing During Production:* Statistical quality control should be maintained on all types of components. Acceptance sampling should be performed regularly. Statistical quality control should include "test-to-failure".
(8) *Redundancy:* The use of two parts that are capable of performing the same given function is often desirable in order that, should one fail, the other can do the job. However, the necessity for redundancy should be carefully weighed against resultant penalties (increased weight, for example). If redundancy is to be applied, it should be carefully checked by both the engineer and statistician. The engineer should determine the feasibility of the proposed redundancy, and the statistician should determine if the redundancy will effectively increase reliability.
(9) *Fully Trained Personnel Who Are Aware of Responsibility:* Everyone involved with rockets and rocket components must be fully trained and aware of the possibly disastrous effect of even one defective component. Each person should prove his competence before he is permitted to work on any parts that are to be used in the field.

As indicated above, applied mathematics and statistics are vitally important in the fields of rocket development and production, especially when reliability is a factor. Qualified men with this background, as well as other forms of science and engineering, have an almost unlimited opportunity to grow and develop at RMI. If you are interested in such opportunities and feel you have the necessary qualifications, there's an excellent possibility that you can become a member of the RMI team. Why not find out today?

*This article is one of a series written by RMI engineers and scientists on different technical aspects of rocket engine design, development and production. Titles of the other articles are:*

**Tailoring Molecules for Rockets** (propellant considerations) 5283
**Taming Rocket Powerplants** (engine control)
**Atomic Radiation for Rocket Testing** (test and instrumentation)
**Servicing Rocket Engines—two parts** (field service)

*If you desire one or more reprints of any of these articles, or would like to receive further information about employment at RMI, write to our Information Services Coordinator, Reaction Motors, Inc., 14 Ford Road, Denville, New Jersey.*

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# BOOKS AND MEN

*Author, critic, and currently Berg Professor of Literature at New York University,* ALFRED KAZIN *here writes with telling insight about Dylan Thomas, the Welsh poet, and his wife Caitlin, as reflected in the opinions of those who surrounded them and in those two revealing books,* DYLAN THOMAS IN AMERICA *by John Malcolm Brinnin and the forthcoming* LEFTOVER LIFE TO KILL *by Caitlin Thomas.*

## THE POSTHUMOUS LIFE OF DYLAN THOMAS

BY ALFRED KAZIN

DYLAN THOMAS's posthumous life began before he died. Before he died, before he lay for days in a coma in St. Vincent's Hospital, New York, while the literati, literary hostesses, patrons, and others milled around the hospital — one lady even came into his room and stared at him for half an hour while he lay trussed up like an animal in an oxygen tent, with tubes in his mouth and nose — anyone up and down the broad literary-academic acreage of this country who heard him read, or watched him drink, could have said to himself, more usually herself, "That man is great, that man is disturbing, nothing so exciting has happened to me since I passed my Ph.D. orals, I am going to remember this, he will soon be dead."

*He will soon be dead.* The legend of the poet-dying-young is based not merely on the opposition between poetic idealism and a materialistic society documented by Chatterton, Keats, Shelley, Hart Crane, but on the romantic faith that true poetry is of a shattering intensity that destroys the poet even as it brings out of him, in letters of fire, the poetry itself. And the expectation is superstitious. What is peculiarly dear to us, what really transports and charms us, what brings new life to us from the hero, the poet, the great man — this, by an automatic human discount, is vulnerable and frail. But beyond these general considerations was the overwhelming single consideration of Dylan Thomas, who seemed not only more gifted, more eloquent, more joyous than any other poet of his generation, but who was peculiarly available to all and everyone, so utterly without pose and literary pomp — he was always ragging his own poetry and, as he beerily filled out, the little barrel figure he made — that alive he was already "Dylan" to every casual pub-mate and literary pick-me-up, with the impending appeal, winsome and rakish, of a Frank Sinatra.

It was this combination of genius and plainness, of force and sweetness, that made so many people write him off from the living before he was dead. He had an old-fashioned "big" gift that made people identify him with the "big" tragedies of old-fashioned poets. Just as many people in England and America who had no contact with advanced poetry read him with a puzzled but obstinate sense that he was important, while foreigners in Germany and Sweden, puzzling out his poems, would say with a sigh, "*This* is a poet," so they knew, they all knew, that he would "die soon." For beyond everything else — beyond the fact that he was endlessly available, that he conducted his life in public, so that everyone knew whom he loved and whom he drank with and how he had turned over a table full of food and drink at Sweet Thing College — lay the overwhelming fact that he was so obviously not in control of his life and did not pretend to be. Perhaps no one is in control any more and it is only in America that people still pretend to be. But the ruling fiction in government and philosophy and education, and even among writers, is that we must all know exactly where we are going and how to get there. As *Time* once noted admiringly about a suburban housewife, "she had life by the tail."

It was just the other way with Dylan Thomas. And it was because in an age full of supremely careful people searching for the "security" of personal happiness Dylan lived without sense, without a bank account, without an analyst, that he provoked the most tremendous astonishment and affection from people who had understandably forgotten what an enormous personal force can lie behind poetry. But he also aroused a certain fear, a fear for him and just as strong a fear of him, of all he could do to people's arrangements and engagements, and this often took the form of wish-



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ing "justice" to be done to him. He was so *outrageous*, as a student once complained, that in certain quarters his death aroused moral approval. And this belief in punishment, in righteous wrath against the outrager, was something that Dylan himself felt. When he first got the d.t.'s near the end of his life, he said that he had seen "the gates of hell." With his background in the shabby-genteel and the Nonconformist Welsh conscience; with his all-too-schoolteachery father and profoundly influential mother (to whom he paid dutiful daily visits at home), he not only felt at the end that he was in hell but that he deserved to be.

Of course he felt this — nobody brought up in our Hebraic-Anglo-Saxon-Puritan tradition ever sins carelessly, is ever totally apart from the sense of "sin." But the essential fact remains that Dylan Thomas didn't yield to that peculiarly American and modern folly of imagining that one can morally insure one's destiny. As a poet and as a very canny observer in several countries, he felt that life in the twentieth century is peculiarly chaotic and measureless, full of desperate private rebellions and self-blame in a society which less and less gives most people any ideal to be faithful to. He felt that metaphysically we have no knowledge and no certainty — he said that his poems had been written "in praise of God by a man who doesn't believe in God" — and that only "the force that through the green fuse drives the flower," the life process from love to death, is real.

And since he lived what he believed, or rather what he didn't believe, it was quite clear, oh, terribly clear long before his death! that Dylan Thomas was wonderful but extreme, and that he would die soon. It was not merely that he behaved badly, that he turned over the plate of canapés at one place and addressed ribald remarks to the pretty young dean of women at another. What made him outrageous to some — and exactly as challenging to others — was that he had, in the provocative sense, no hope.

He had no hope. I don't pretend to know exactly why this was, and it's too easy to say, as so many have, that he drank in order to recover the first excitement of his lyrical gift. I think that fundamentally his lack of hope came from the lack of ideas suitable to the boldness of his temperament and vocation. He had no philosophy or belief that could express for him, that could work for him, that could even explain the burden of love and terror before the natural world that is the subject of all his poetry. He was almost the pure type of the romantic artist in our world, determined to write only "happy" poems that would show life as joy. But he was unable or unwilling to bridge the gap between the splendor of his solitary conception and the deadness of the world without the poet's light on it. All of Thomas's poetry shows the profound romantic need to intensify existence, to make it all come alive as it is in personal consciousness. But where so many great poets — Blake, Wordsworth, Keats, even Whitman — have recognized that their task is not to lose their new vision to the commonplace world but to explain and to unite it to human existence, Thomas felt absurd and histrionic, acted like a man who in his heart thought himself a fake.

He was too humble. It is a strange thing to remember of anyone whose gift was so personal and sweeping, but he regarded his own gift as slightly absurd; he sheltered it, wouldn't have his poems discussed, because he couldn't admit that poetry *is* thought, and that what he said in his poems many of his contemporaries really believed and were most deeply grateful to a poet for saying again. He was left with his fantastic linguistic gift as if it were something to read from, to entertain with, but not, in the artistic sense, to practice as a criticism of life.

But then, how could he have felt this in our age? The great romantic manifestoes were charters of human liberation by poets who identified themselves with new classes and revolutionary new ideas in society. In the gray drab British welfare state, Dylan Thomas felt like a "spiv," a juvenile delinquent. Being an utterly accessible and friendly and idle-feeling man, he couldn't help seeing himself as a faintly comic version of that universally respected legend, "The Poet." The public entertainer in him exploited the miseries of that humble bloke, that rumpled and tired Welshman, Dylan Thomas, who had no trouble enjoying his gift but who sometimes looked on it as something that had oddly been given *him* — he couldn't say just why! About other poets he could be utterly conventional in his admiration; his BBC talks on poets of Welsh background are banal. He even read the poetry of others with steadier power than he did his own. But if he was more reserved with people and perceptive about them than anyone watching him would have guessed, he was, about himself, without hope in the sense that he had nothing with which to explain and to justify the utter naturalness and human application of his poetry.

He believed in himself as a poet, there is no question about that; what he didn't believe in was what it was peculiarly the task of someone with *his* genius to believe in: that his poetry gave us truth about life and was a judgment on all of us, not just on himself. When people say that he drank in order to recapture the old ecstasy, his



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first excitement, they forget that his problem was not merely to recover this ecstasy, which understandably flagged, but to believe in it. Only this would have shown that he was in fact as great as others knew he was.

But guessing at his vulnerability, people foresaw his early death; and observing his abandon, they mistook his hopelessness for confusion. Obviously no poet of such fierce perception can tidily put his life away when he is not writing. The poet lives the truth he has to write, and when he is not writing he may live it in a chaos of unorganized sensations, of an excitement throwing itself upon life, that can bound back and destroy him. And Dylan Thomas's lack of "hope," in the specific sense in which I have tried to state it, should not obscure the central fact that as a poet he was the very opposite of the anxious salvation-seekers who are so dear to contemporary poetry. The tremendous vogue of Thomas's poetry stems from the fact that after the era of would-be "hard," pseudo-Christian verse of T. S. Eliot's followers and the self-conscious ironies of Auden, Thomas brought back to poetry resonance of feeling, the connection with nature, love, and death which is the peculiar power of poetry and which Rilke defined as "the past that breaks out in our hearts."

The deepest side of such poetry — and of such an attitude to poetry — is not merely that it rests on images which are to be accepted literally in their unmediated force, but that it represents an attitude toward life itself which is the opposite of control, complacency, and deliberation. In Thomas's poetry, life speaks *through* us:

> The force that drives the water through the rocks
> Drives my red blood;

man is an instrument of the energy that is divine; he is not, to use the American idiom, "structuring" life to make all things neatly realizable and containable. Ours is an irreverent culture. In the work of Thomas — and of Thomas's beloved Whitman — life, in the final vision, attains not a definite character but the quality of a worshiped and awesome natural force. It becomes a great fire, beyond man's ability to put it out, but to which he is glad, at most, to get near, still nearer, so as to be able to get down in words a breath of this radiant flame.

Obviously, then, Dylan Thomas represented for many Americans a rare touch of greatness, a relief from the ever-pressing success story. He embodied, without a word said to this effect outside his poetry, the pure romantic vision that is still admired in America underneath the automatic responses of our culture. No matter how fussily detailed and self-conscious our lives become, there is in our fundamental classlessness and our physical restlessness freedom from the frigid respectability that can be so depressing a feature of middle-class life in Britain. And Dylan was so friendly, in this respect so much like an American, so easy to call by his first name! He encountered a welcome here which not only made him feel as if he were free-floating in a sky made up of unlimited parties, girls, and liquor, but which, in the heady, inflated, overprosperous, overstimulated atmosphere of America since the war, must have made him, with his peculiarly heightened capacities for life, feel that he had been sent spinning out of the damp, dark wrappings of seaside life in Wales and hack work in London. The more uncontrolled he felt about life, the more he fell upon American parties, American excitement, American adulation, as if everything came from a rich, infatuated, always indulgent mistress. He drank here not like an alcoholic who enjoys his liquor, but like a fat boy gobbling down chocolate bars who can't believe that they make him fat. Inevitably, his death here made it seem to many glumly envious and depressed Britons at home as if Dylan Thomas had died of America as well as in America, and as soon as the news of his death at thirty-nine reached London, the word went out from his old literary pals that "America killed Dylan Thomas."

In a sense it was true. Just as many Americans die of the American way of life, of the American pace, of American traffic, so Dylan Thomas's end was certainly speeded by that unlimited supply of hard liquor without which nobody dares entertain any more, and which is not only more difficult to obtain in Britain, on British incomes, but which became to Dylan what poetry might have been if, in his own rueful words, he hadn't been flying over America "like a damp, ranting bird."

But it is also true that since the war a great many Britishers haven't needed to find in Dylan Thomas's death a reason for being exasperated with America: they already have so many. Any American who follows the British literary and highbrow press becomes hardened to the bitter and sometimes hysterical jealousy of this country — particularly from Marxists who can't bear to admit how much, in different fashions, Russia and the gray British welfare state have let them down — but it is ironic that Dylan Thomas's death should be blamed entirely on America. Like so many romantic writers, he felt a natural affinity with this country, while in Britain, being utterly outside the "Establishment," he was re-



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garded with a certain loving contempt by some of the snobs who so righteously gnashed their teeth after his death. Nevertheless, Thomas's death was a terrible loss to his own people, to his own kind, and it is really because the mediocrity of literature today is less cleverly concealed in Britain than it is in this country that the death hit so hard.

THE posthumous life of Dylan Thomas as a legend and a symbol — the last romantic poet in a conformist society, the Welsh lyric singer corrupted by the American fleshpots — became really intense when the personal rivalries between those who had loved Dylan came out into the open. Now that he was dead, many people felt an enrichment of their lives through their retrospective share in him. The fact is that Dylan Thomas was a peculiarly lovable as well as magnetically gifted person, that he inspired a great many gifted people with the sense of an unusual radiance in their lives. And just as the many elegies after his death addressed him with an intimacy that is inconceivable in relation to any other famous poet of our time, so the extraordinary agitation he inspired lives on after him in the fascinated reportage of every detail of his life by people who obviously preferred Dylan drunk to anyone sober.

John Malcolm Brinnin's *Dylan Thomas in America* was, of course, the principal tool in shaping the posthumous legend of Dylan Thomas. And it is a mark of Thomas's fantastic vitality in death that a great many people who don't read his poetry, but who very properly see his life as a symbol of it, have found in Brinnin's book the documented record of what they regard as the very poetry of excess. They love this excess because it gives them a touch of the old romantic heedlessness and abandon, the price of which they do not have to pay, and which, as they read in Brinnin the account of Thomas's terrible last days, makes them shudder at an end so violently consistent with his life.

It is no accident that in our period the unconscious protest of so many young people against an overregulated but vacuous society is embodied in the admiration of recklessness which one sees in the cult of the young movie actor, James Dean, who died speeding; and that among a great many of the young intellectuals there is a similar cult of "Dylan," whose extraordinary records are fancied by the same people who admire the new jazz and hot rods. In colleges all over the country, listening to Dylan's voice as, "crooning" his poems, he still tries to catch his breath between lines, young people get from him the same suggestion of pure feeling that they get from good jazz. The California poet, Kenneth Rexroth, has linked as heroes of "the beat generation" "two great dead juvenile delinquents — the great saxophonist Charlie Parker, and Dylan," and insists that "if the word deliberate means anything, both of them certainly destroyed themselves. . . .

"Both of them," Rexroth has written, "were overcome by the horror of the world in which they found themselves, because at last they could no longer overcome that world with the weapon of a purely lyrical art. . . . Both of them did communicate one central theme: Against the ruin of the world, there is only one defense — the creative act. . . . Dylan Thomas's verse had to find endurance in a world of burning cities and burning Jews. He was able to find meaning in his art as long as it was the answer to air raids and gas ovens. As the world began to take on the guise of an immense air raid or gas oven, I believe his art became meaningless to him." And in a violent but deeply moving elegy to Thomas, "Thou Shalt Not Kill," Rexroth attributes the poet's death to the superficiality of his contemporaries:

> Who killed the bright-headed bird?
> You did, you son of a bitch.
> You drowned him in your cocktail brain.
> He fell down and died in your synthetic heart.

The bitterness in these lines is by no means unusual. All over the country, often in isolated places, there are people, more especially young people, who look on Thomas as a rebel against mass society and a victim of the organization man. It is in America, at the antennae of the modern age, where the full force of technological culture is felt, that the cult of Dylan Thomas has reached its peak — documented, too often, from the remorseless day-by-day record of Thomas the drunk and the wastrel which Brinnin put down with so much fervor and unconscious resentment against the elusiveness of this magnetic figure. So closely do people feel related to Thomas that there are endless arguments still about Brinnin's book, for people tend to identify with Thomas to the point where they resent its itemization of his "lapses." When Brinnin admitted that he could not really account for Thomas's more extreme behavior, he meant that he did not want to and was punishing him for being so unmanageable. But to the "ardents," Thomas's life in itself, not in relation to them, has a heroic significance quite the opposite of the continuous disintegration that Brinnin leaves us with.

It was in protest against this impression that Dylan's widow, Caitlin Thomas, offered a brief foreword to Brinnin's book. And now that her



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own memoir, *Leftover Life to Kill* (Atlantic–Little, Brown, $4.50), has finally been written, a most important word from the most intimate source of all has been said. In his posthumous life Dylan Thomas really speaks now, through his widow. Caitlin Thomas's book is not the "answer" to Brinnin — the mere justification of her husband — that had been expected. It is better than that. It is an amazing duplication of Thomas's own strength and recklessness and abandon by a woman who obviously was the only person with a spirit equal to his and who consequently fought him and hated him and loved him to the point where their conflicting intensities almost killed each other. The only thing I don't admire in Mrs. Thomas's book is the self-pity in the title and a would-be pathos, at the end as at the beginning; but the self-pity is utterly shown up and exploded by the fierce emotional charge of the book and a powerful style which, once she gets control of it, gives one the same pleasant Celtic resonance from her careening Irish sentences that one gets from his tipsy Welsh ones.

The people who will be shocked by Caitlin Thomas's book would be shocked by Dylan Thomas if he were alive. A posthumous life is easy to take, for us who deal with it as symbol; Caitlin Thomas is so much alive that her book, which is as much about herself as about Dylan, never explains Dylan's directness and eloquence so much as when, with amusing honesty and perfect tenderness, she recounts her life on the Isle of Elba with a young Italian miner, surrounded by the violently hostile respectable.

There is about her, as about Dylan, a perfect genius for trouble. She is a born rebel who in today's situation doesn't know what to rebel against. She has her husband's instinct for extreme and desperate situations. But reading the account of her dismal life in Wales after Dylan's death, and of her flight to Elba with her five-year-old son, I could not help feeling that, given her temperament, she behaved with exemplary courage and humanity. What makes the book so remarkable is that, time and again, whether she is writing about Dylan, or herself, or her children, one hears the boisterous Thomas lilt, the authentic note, the lyrical cry from the heart that gives his style its force. And most unexpected and revealing, she makes it clear that in her, as in Dylan, is the fatal mixture, with her powerful temperament, of that intellectual frailty, that excessive availability and need to be loved, which so many pettier types have known how to protect themselves from.

The tragedy of Caitlin Thomas is not what she says it is — not entirely a matter of the tempestuous life with a genius as erratic as herself or of the subsequent loss which, frightful as it is, has obviously given her back to herself. The tragedy is in the excessive vulnerability, the constant readiness to be hit in the face which, in a person with her insurrectionary heart, cripples her at the very moment that she can rise to her full strength. She tells us that she had a passion for solitary dancing à la Isadora Duncan, where she could feel the "flowing" — but "as soon as I spotted the 'glance' of an audience, I was finished: the brain on the alert, all suspicion again, put the pincers on, and the capricious flow stopped abruptly. . . .

"That was one reason, now I come to think of it, why Dylan found it so annoying: it is the direct opposite of words. . . . It may be one of the substances that poetry is made of; that words are formed from; but its elemental — right back, through the encumbering ages, to the creation, the planets, the dinosaurs; the skeletons and protoplasm — force is, above any other point of supremacy, *wordless*. . . ."

Actually, her sense of what art means to her — this elemental force, right back through the encumbering ages — is exactly what makes her husband's poetry so vivid. In her, as in him, there is this same exciting and disturbing combination of force without hope — without a meaning she can assign to her experience that would relieve her from emotional suffering. Her rule of life, she says, is "always be ready to clasp the impending disasters," and I believe her. So that despite the essential modesty that seems to me the key to the tragedy of Dylan Thomas and the long-delayed emergence of his wife, it is this elemental force for which one remains grateful in reading her book. It is so much rarer than a "defense" of Dylan Thomas — who needs none.



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# BOOKS AND MEN

BENTZ PLAGEMANN *worked as a book clerk in various bookstores around the country for eight years before volunteering for the Navy hospital corps in World War II. He was stricken with polio in North Africa, and from his experience came his book,* MY PLACE TO STAND. *He is also the author of three novels, and one of his stories, "The Best Bread," was included in the O. Henry* PRIZE STORIES OF 1949.

## THE GLORY THAT WAS GROTE

### BY BENTZ PLAGEMANN

WE ALL know what the wages of sin are, or is, but sometimes one is paid off in coin of the realm well in advance of the funeral, as I once learned by reading a pornographic book under rather unusual circumstances. It happened some time ago, in the years before World War II, when I was working as a clerk in Brentano's Bookstore, on Fifth Avenue at Forty-seventh Street.

Specifically, I served as assistant to Arthur Brentano, Senior, a charming and witty man. Mr. Brentano, then some eighty years old, had spent the major part of his life in Paris, managing his store there, a famous meeting place for American expatriates. When war seemed imminent, his family decided that because of his age it might be best for him to come back to New York. This was, I believe, in 1937 or 1938, and when he returned to the Brentano store on Fifth Avenue, he went about his business there much as he had always done.

His particular interest was in old and rare books and in books in fine bindings; now, instead of attending auctions in Paris or at Christie's in London, he bought books for his store from the estates of old American families. Often this meant traveling to other cities, particularly to places in New England, and in his absence I remained behind in the store in New York to take care of certain details for him.

The part I enjoyed most about this phase of my work was that sometimes the books he had purchased from a particular estate arrived before he returned, usually because he had heard of another library near by which he wanted to examine before coming back to New York. The books would arrive, carefully packed in cartons. These were brought to a certain place in the basement of the store, a place, as I remember it, rather like a bank teller's cage only much larger, framed with heavy wire, with a door which could be locked at night to safeguard the books. I opened each carton with the anticipation and pleasure which a child feels on Christmas morning, for each shipment was certain to have its own treasures, perhaps an early Poe or Whitman or books finely bound abroad which had found their way to American collections. There was something particularly pleasant, which I suppose only another lover of books will understand, about being alone in a quiet place to examine these old volumes, each a mystery in its separate wrapping of newspaper, a safeguard against rubbing in shipment.

After they were unpacked there was a routine to be followed in which I had been painstakingly trained. It could be assumed that they would be dusty from long sitting on library shelves. I had gone into bookselling almost as a boy, and my first instruction was a firm warning against the housewife's sin of dusting. The tops of books were never to be dusted with a cloth, because this method only grinds the dust in and stains the page edges. Books were dusted by clapping them together two at a time, with a brisk, flat motion which would cause the dust to spring away in a small cloud, usually finding its way to the book clerk's lungs, an occupational hazard with which I was most familiar, but which I suffered gladly rather than impair the condition of the books. They then could be dusted with a soft cloth on the back and the front and the spine. Spots could sometimes be removed from board- and cloth-bound books or the paper labels cleaned with gum rubber, but a more lengthy process, called "furbishing," was indicated for leather-bound books.

Leather-bound books which had stood for a generation, or generations, on open shelves, especially in houses with central heating, were



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usually dangerously dry. To treat them, a compound composed of lanolin and a cleaning agent was applied liberally, often in more than one application, as the thirsty leather absorbed it. The books were then placed on end until they were dry, after which they could be polished with a soft cloth.

But actually the most important step of all in dealing with old volumes which had come from private collections was to submit them, after clapping and before furbishing, to another process called "riffling." It is well known among collectors and dealers that books make convenient storing or hiding places for letters or clippings or photographs. These are the items most commonly found, but in older collections from older houses, where perhaps the same family has lived long enough to produce its share of eccentrics, wills or deeds or even money may be found.

In riffling, a book is held downward by its covers with the two hands, and as the book is opened the pages are quickly run through with the thumbnail of one hand, at which anything hidden will drop to the floor. I had heard many tales of strange findings, and while I had never turned up anything of interest myself, I was always most scrupulous about the riffling step in my dealings with old books.

On the occasion which I have in mind, Mr. Brentano had gone to an old house somewhere, I think, between Boston and Milton to buy from the executor of the estate the library of a family whose last member had died. In such an instance Mr. Brentano would generally be required to buy the entire library, even though only a few of the books might be of interest or value to him, so that the executor could terminate that part of his business. Unscrupulous booksellers, unlike Mr. Brentano, often take advantage of such a situation by offering a flat price for an entire library without revealing to the seller the value of any particular books in the collection.

In another bookstore, where I had received part of my early training, I knew of one such instance when an entire library was bought by our scheming dealer in old books merely because it contained a first edition in the original binding of Louisa May Alcott's *Little Women*, a truly rare American book, whose value was unknown to the executor of the estate. The rest of the library was worthless, and our dealer, before going on to another city for an auction there, ordered that all of the volumes be dumped on open tables in the store and sold for twenty-five cents apiece. The irony, or poetic justice, of this unrelated story is that the clerk who unpacked that shipment of books failed to receive his full orders, and the first edition of *Little Women* went for twenty-five cents along with the others, since our dealer would have given himself away if he had removed it from the shelf while the books were being packed.

Mr. Brentano, always honest and fair, bought individual books, taking each of those that interested him from the shelf in turn and making his offer. When this had been done he offered a flat price for the remainder. In the case of the Massachusetts library, there were many books of interest and value, and these he had packed separately in marked cartons. The rest of the library was sent along in other cartons, preceded by a letter of instruction to me, since Mr. Brentano was stopping at New Haven for a few days before coming back to New York. We were having at that time in the Fifth Avenue store a sale of old books and books in leather bindings, and in his instructions Mr. Brentano explained that he would like this new collection put out with the sale books so that they might be quickly disposed of at prices he indicated.

The books to be sold arrived on Friday afternoon, and since the sale ended the following day, this meant that the cartons had to be opened and the books cleaned and brought upstairs before the store closed at six o'clock. When I opened the cartons I saw that the job would not present any difficulties. The books, even the old ones, were clean and had obviously been cherished and cared for. They were the usual sort of things one finds in a country house: odd volumes of poetry, essays, and the classical writers; sets, in buckram, of Dickens, Thackeray, and the Waverley Novels; and some sets in leather, including Grote's *History of Greece* in five volumes, bound in blue three-quarter morocco.

I began to sort them on a long table, putting the sets together to make certain they were complete and roughly classifying the odd volumes by subject. They were tied together in lots, and suddenly, between two volumes of Herodotus, I found a smaller volume. To my infinite astonishment, it was a copy of the *Kama Sutra*.

I knew of the existence of this great erotic book of India on the methods and the techniques of love, but it is forbidden in this country and I had never seen a copy. I could not imagine how it had come into this lot of books, although I suppose it had found its way into the Massachusetts library, as so many exotic objects came into New England, by being brought back home by some seafaring man of the family.

My first thought, which was later proved correct, was that Mr. Brentano himself did not know it was there. It had probably been placed on a shelf behind other books, as such books usually are,



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and when the library was packed by a workman, he simply tied it up with the others. I sat down in my chair and opened it. It had been translated into English with great skill and style, obviously by a scholar, and at once I was lost to all other considerations.

I had gone down to the basement at half past four. When I looked at my watch again it was ten minutes before six. I could have stayed on and let myself out of the store, but I had been invited to a dinner party and I had to go back first to my room and dress. I jumped up, carefully hid the copy of the *Kama Sutra* on a dark shelf, and looked at the work in front of me. A little dusting, I thought, would do the job. The cloth-bound books were clean, the leather-bound books were in good condition, and since they were going on sale anyway it was probably not necessary to furbish them. And surely, I argued with myself, it would simply be a waste of time to riffle the books from a library such as this. Quickly I gave them all a light dusting and carried them upstairs to put them out on the sale tables for the morning.

Saturday is a good day in the book business, and the next day we did very well, selling nearly all of the sale books we had on hand, including the new shipment. On the following Monday morning, as I was gathering up the last of the remaining books to pack them away for a future sale, an attractive young matron, whom I had served on Saturday, came into the store. She wore a radiant look and she came toward me quickly, hardly able to keep her smile from breaking into laughter.

"Do you remember the set of Grote you sold me on Saturday?" she asked.

I said that I did indeed. She had bought it for eight dollars and a half, as I had been instructed to mark it, which I thought a very good price.

"Well," she said, flicking her gloves at me playfully, "I am not going to tell you how many I found, but the whole set was interleaved with twenty-dollar bills."

## BROWN STUDY

BY R. P. LISTER

Deep in a dream I dwell;
  deep in a dream-bound dell
    darkly I drowse.
Books are my drugs of bliss,
  books are the lips I kiss,
    the fields I browse.

See, from the laddered shelves
  Shakespeare and Swift themselves
    speak straightly down;
Bunyan and Blake are born,
  minted afresh each morn,
    mind-kings to crown.

So in my silent head
  shout the gigantic dead
    and wisely cry,
While in the world outside
  turn time and toilless tide,
    and seasons fly.



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# THE ATLANTIC BOOKSHELF

Karsh

## *The Peripatetic Reviewer* BY EDWARD WEEKS

AUTOBIOGRAPHY is the oldest living form of literature, older even than the song or saga with which the wandering poet paid for his keep. "Just as I stepped out of our cave, there in my path and coming right at me and as big as a mountain was a mastodon. . . . It was bull luck that he never saw me." That is the Stone Age man speaking, and though he used a coarser, more primitive term for the snorter than mastodon, that is probably the way he began to embellish the tale for his home folks. Danger was the stimulant.

Autobiography is prompted by danger and by discovery. This is true of Hakluyt's *Voyages* and equally true of some of the most adventurous writing of our time. But these of course are not the only sources. Autobiography may emerge from the quiet devotion of a country doctor in Kansas or the rounds of a country editor on Martha's Vineyard, or it may be the life story of a woman who keeps the lighthouse off Nova Scotia. Autobiography is the taking into confidence, the sharing of experiences so universal that readers gain by seeing how others meet them. It is the participation in life in Tibet or tropical Africa or China, which we can only know vicariously; it is the exhilaration of a theatrical career such as Sacha Guitry and Noel Coward have described; it is Jacob Epstein telling of the problems and the mastery of sculpture or Agnes de Mille portraying the disappointments and defeats which a ballet dancer must suffer before she can hope to capture the Metropolitan; it is the dedication of a compassionate doctor like Edward Trudeau of Saranac or the hardihood of a brave missionary like Sir Wilfred Grenfell; it is an exploration of the human spirit and the most direct way of communicating one's zest for life.

The freshest of autobiographies are those written about the morning of life, those books which magically preserve the elixir of youth. Two of my favorites were written for the *Atlantic* long ago. The first is by a Virginian, George Cary Eggleston, whose book, *A Rebel's Recollections*, which we published in seven installments in 1874, did more to disarm the North than any other volume by a Southerner. He had ridden with Jeb Stuart in 1861 and commanded a battery in the seige of Petersburg, and when he returned to his family plantation in Albermarle County, he accepted defeat with no trace of self-pity. What he wrote was manly and magnanimous. The other book appeared in our columns the next year — *Life on the Mississippi* by Mark Twain. Mark wrote it at the urging of William Dean Howells, and the pages still have on them the dew of his boyhood. In it is his nostalgia for Hannibal, that sleepy river town; there are hints of his unhappiness at home, from which he ran away, but this is forgotten in the buoyancy of his experience as cabin boy and cub pilot on the glamorous Mississippi River boats. Books such as these are filled with an irrepressible spirit.

There is a second category — books written in midstream by men and women who have come through a unique experience so compelling, so trying, that it must be told. Such books have been plentiful in our time, because we have been living so dangerously. To list the titles is to conjure up these pages of vitality: *Seven Pillars of Wisdom*, T. E. Lawrence's searing and romantic adventures in Arabia; *The Spirit of St. Louis*, in which Charles Lindbergh relives the greatest flight of our era; that eye-opening book on Africa, *Venture to the Interior*, by Laurens van der Post; for its mercy, *Three Came Home*, by Agnes Newton Keith.

Finally, and rarest of all, are those books of culmination, autobiographies written in the sunset, with the mind crystal clear in its recall and wise in its judgments. *The Education of Henry Adams* is one such, and so is Sir Osbert Sitwell's five-volume autobiography, with its golden imperishable picture of an England that is vanished. Of the books



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# The Peripatetic Advertiser

Eighty-seven years of the Atlantic's century are shared by a man who has had a profound effect on the course of economic and political policy in America. In **Mr. Baruch** by **Margaret Coit** ($6.95) the man dominates the myth. Few biographers have had such a wealth of paradox to weigh. Even the myth, simplified by the chiaroscuro of publicity, is enigmatic.

A capitalistic financier consulted by the Soviet Union, a patriot who has influenced the governments of Europe, the accumulator of a great fortune who has given freely of his time and his money, the state rights Democrat who has planned and managed great concentrations of power in the federal government, the loyal son of South Carolina who is a Wall Street legend, the adviser to seven Presidents who has made his reputation as a park-bencher — this is the figure in history. To assess the man Margaret Coit has spent six years of research in the voluminous Baruch papers, supplemented by extensive conversations with Mr. Baruch, his acquaintances and friends. This is not authorized biography, it is not that private image of a man as he sees himself — it is, however, magnificent portraiture of one man and his America by a writer who began her career by winning a Pulitzer prize. **Mr. Baruch** was originally announced for August 20. It has been made a reserve selection of the Book-of-the-Month Club and is now planned for publication on November 21.

And politics in America has inspired a lot of honest, toughminded fiction. In **James Reichley's The Burying of Kingsmith** ($4.50) a young novelist makes a brilliant debut in a story of the private bids for public power in a Pennsylvania town. Under the cover of the pretentious funeral for a young mayor, the slick and rapacious struggle for control takes shape. Long before publication the distinction of this novel was reflected in the reaction of advance readers: —

"It is rare to find a first novel combining factual accuracy about political conditions with a serious psychological study of a large number of interesting characters . . .

"The book should rank with 'The Last Hurrah' and '10 North Frederick' . . ." — *Senator Joseph S. Clark*

"A brilliant first novel, lively and trenchant . . ."
— *Arthur Schlesinger, Jr.*

"A brilliant spokesman for his generation and an uncommonly forceful and gifted writer."
— *Richard Rovere*

**The Battle of Cassino** ($4.00) by **Fred Majdalany** is history in what has come, since World War II, to be the new grand manner. It is lucid, dispassionate, controlled in design, yet it is illuminated in every detail by revelatory personal incident, by the charged emotional intensity of a participant. Cassino, perhaps the most perfect natural defensive position in Europe, was destined to be the center of one of the war's most bitter and protracted political controversies. Majdalany sums up, "Cassino was in the end little more than a victory of the human spirit; an elegy for the common soldier; a memorial to the definitive horror of war and the curiously perverse paradoxical nobility of battle." To write the story of these four months Fred Majdalany spent three years in concentrated research with the cooperation of Allied and German war offices, conversations with commanders of the opposing forces, and the aid and hospitality of the present abbot of the monastery. Mr. Majdalany's earlier book, a short novel, *The Monastery*, was called "a minor classic." This one, full-size in every respect, is major.

**Parkinson's Law** *and Other Studies in Administration* ($3.00) by **C. Northcote Parkinson.** Illustrated by Robert C. Osborn. Quite possibly the most subversive book of the season. However, subversive is a victim's word. With this book at hand you can assess relative strength in the committee you are gracing: — "Five members are easy to collect, of these original members four may well be versed, respectively, in finance, foreign policy, defense, and law. The fifth, who has failed to master any of these subjects, usually becomes the chairman or prime minister." Or your wife can determine optimum position at a cocktail party: — "To find the people who really matter, divide the whole floor area (mentally) into squares. Letter these from left to right, as you enter, as A, B, C, D, E, and F. Number the squares from the entrance to the far end as 1 to 8. The hour at which the party begins should be termed H. The moment when the last guest leaves will be approximately two hours and twenty minutes after the first people arrive. We shall call this H + 140. To find the people who really matter is now perfectly simple. They are the people grouped in square E/7 between H + 75 and H + 90. The most important person of all will be in the very center of the group."

However it is a game at which two cannot happily play. Be the first in your circle to read the book and master the formula for determining the coefficient of inefficiency. The path to retirement will then be made easy for you.

**Houghton Mifflin Company,** ***Publishers***


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about writing, I should put first Anthony Trollope's *Autobiography* and *The Summing Up* by Somerset Maugham. Of the books which I have personally edited the dearest to me is *As I Remember Him* by Hans Zinsser, which is on the border line between biography and autobiography. It is in its truth the telling of a career richly and fully lived, but Dr. Zinsser, like many a writer before him, had no liking for the first person singular; he wished to be free to come and go, to open some doors, to leave others ajar. He saw that Henry Adams had solved this difficulty by writing in the third person, and so he in his own way devised a style which would give him the latitude and reticence which he wanted. Dr. Zinsser, again like other writers before him, wrote with the knowledge that he had only a limited time left. When he began he was in full command, but he did not know whether leukemia would permit him to finish. This pressure brought no sign of haste to the writing, never disturbed the urbanity or shortened the humor. Rather, I think, it added a depth and a poignancy to what he said.

### "BUY LAND, AND NEVER SELL"

The story of Richard King is a success story of Texas dimensions. He was the son of Irish immigrants who apprenticed him to a New York jeweler at the age of nine. When he ran off to sea, his first captain took pity on him and sent him back to Connecticut for schooling, but he ran off a second time to complete his education as a deck hand and pilot on the river boats of the Southwest. He was rugged, two-fisted, and fortunate in his friends. Captain Mifflin Kenedy, a well-educated Quaker whom he met on the Rio Grande, became his lifelong partner. And when in 1853 Captain King decided to give up boating and try his hand at cattle raising in the Wild Horse Desert — a rough and violent land — it was Lt. Col. Robert E. Lee of the Second United States Cavalry who helped him pick a site for his ranch house and who gave him the advice which became a family slogan: "Buy land, and never sell."

The original purchase of 15,500 acres of wilderness (at two cents an acre) has grown to 700,000 in southern Texas with additional holdings in Kentucky, Pennsylvania, Australia, Cuba, and Brazil. In **The King Ranch** (Little, Brown, 2 vols., $17.50) **Tom Lea**, himself a Texan, writes the biography of this great enterprise and the men who built it. It is a chronicle of the cattle industry, the history of an era, and the biography of a big man, practical, ruthless, and visionary.

The first volume is naturally the more appealing, for this is the history of the pioneering. Inevitably there are gaps in the story, for Richard King was not a journalist, but he trusted his lawyers implicitly; he had good ones, and through them the financial record could be traced. Mr. Lea has pieced together the home life picturesquely and with many a heartening touch: the taming of the Captain by Henrietta Chamberlain, daughter of the minister in Brownsville; the honeymoon in the desert; their brush with the Indians; their friendship with Colonel Lee; the courage with which Henrietta governed the outpost when her husband was away. His fortunes rose instead of declining with the Civil War, for his ranch was really "the back door of the Confederacy." His beef fed the armies, his ships smuggled cotton through the blockade. The growth of the great herds; the private wars against the Mexican cattle thieves and the home defense against the Federal raids; the legal squabbles over the fencing and the intelligent concern for pasture, water, and a better breed — these were the most engrossing activities of the rancho. And there was always the fear of drought. It was often uphill work, as one of the Captain's notes describes: "Dear Rube: Where I have grass, I have no water. And where I have water, I have no grass. The Mexicans won't work and things are getting in a hell of a fix fast." The owner of the running W brand came to be known from the Rio Grande to Canada.

In the second volume the family holdings and the family itself begin to ramify, with a division of interest. The story is still one of growth, though the background is less glamorous. The spotlight now centers on Robert Kleberg, the son-in-law who succeeded as manager. Where King was pioneer, Kleberg was developer. His enterprise, his economy, his genius for conservation extended the operation.

Every year since 1936 the ranch has sold more than a million dollars worth of beef on the hoof, but no statistics can convey the ranch's final meaning. Here are men in the fifth generation still doing their utmost for herds and grass. It is an American achievement, and so too are these volumes of its history, with the maps and beautiful drawings by Tom Lea, and the clear, strong typography of Carl Hertzog.

### HISTORY IN THE GRAND STYLE

**The Age of Revolution** (Dodd, Mead, $6.00), Volume III of his *History of the English-Speaking Peoples*, is a book **Winston S. Churchill** must have enjoyed writing. The three rebellions in it, the English Revolution of 1688, the American Revolution, and the French, give his political genius an ample opportunity for exercise; what is more, the fighting which preceded and accompanied these upheavals thrust into command



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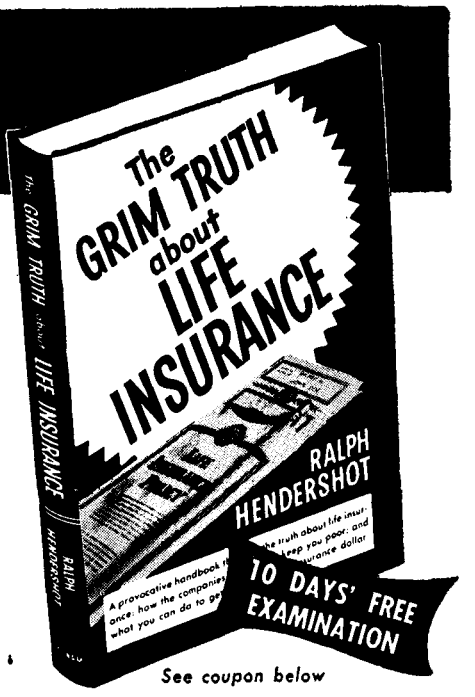


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great fighters whom he delights to honor — Marlborough and Prince Eugene, Nelson, Wellington and Napoleon. He knows their campaigns by heart, and writes of them with choice and vivid detail. Finally, in these years from 1688 to 1815, it is his pleasure to record the emergence of England as a world power and the acquisition by war and treaty, usually at the expense of the French and Spanish, of England's greatest Empire. This acquisition is something of which he is properly proud, and the statesmen whose will and vision brought it together — Marlborough, Pitt, Clive, Edmund Burke, and the Iron Duke — are leaders whom he can assess as their peer.

It is clear from internal evidence that this book was written in 1939, when the author was out of office and totally out of sympathy with the complacency of Baldwin, which had led to the ineptitude of Chamberlain. He says, writing of the reckless reduction of the armed forces carried out by the Tories in 1698, "In the name of peace, economy, and isolation they prepared the ground for a far more terrible renewal of the war. No closer parallel exists in history than that presented by the Tory conduct in the years 1696 to 1699 with their similar conduct in the years 1932 to 1937. . . . These recurring fits of squalor in the Tory record are a sad counterpoise to the many great services they have rendered the nation. . . ." Such judgments as these give his book a special authority.

The emergence of Great Britain; the emergence of the two-party Parliament free from corruption by the Crown; the emergence of "a Prime Minister" (Mr. Walpole was the first, and the term was used about him in derision); the acquisition of the Empire; the development of the Navy; the interminable and costly wars against France — these are themes on which Churchill plays as on an organ. He says little about the arts and the writers, and the growth of the American colonies and their breaking away is an episode which he cannot regard for long without dismay. His style, which can be as sonorous as Gibbon's, has in it the flick of irony and the swift revelation of character, and his quotations are pert and juicy. He says, speaking of the speculation at the time of the South Sea Bubble, "One promoter floated a company to manufacture an invention known as Puckle's Machine Gun, 'which was to discharge round and square cannon-balls and bullets and make a total revolution in the art of war,' the round missiles being intended for use against Christians and the square against the Turk." He says, speaking of the Scottish clans who rallied to Bonnie Prince Charlie, "The clans were always ready to fight, but never to be led." One looks for such plums, and they are always there.

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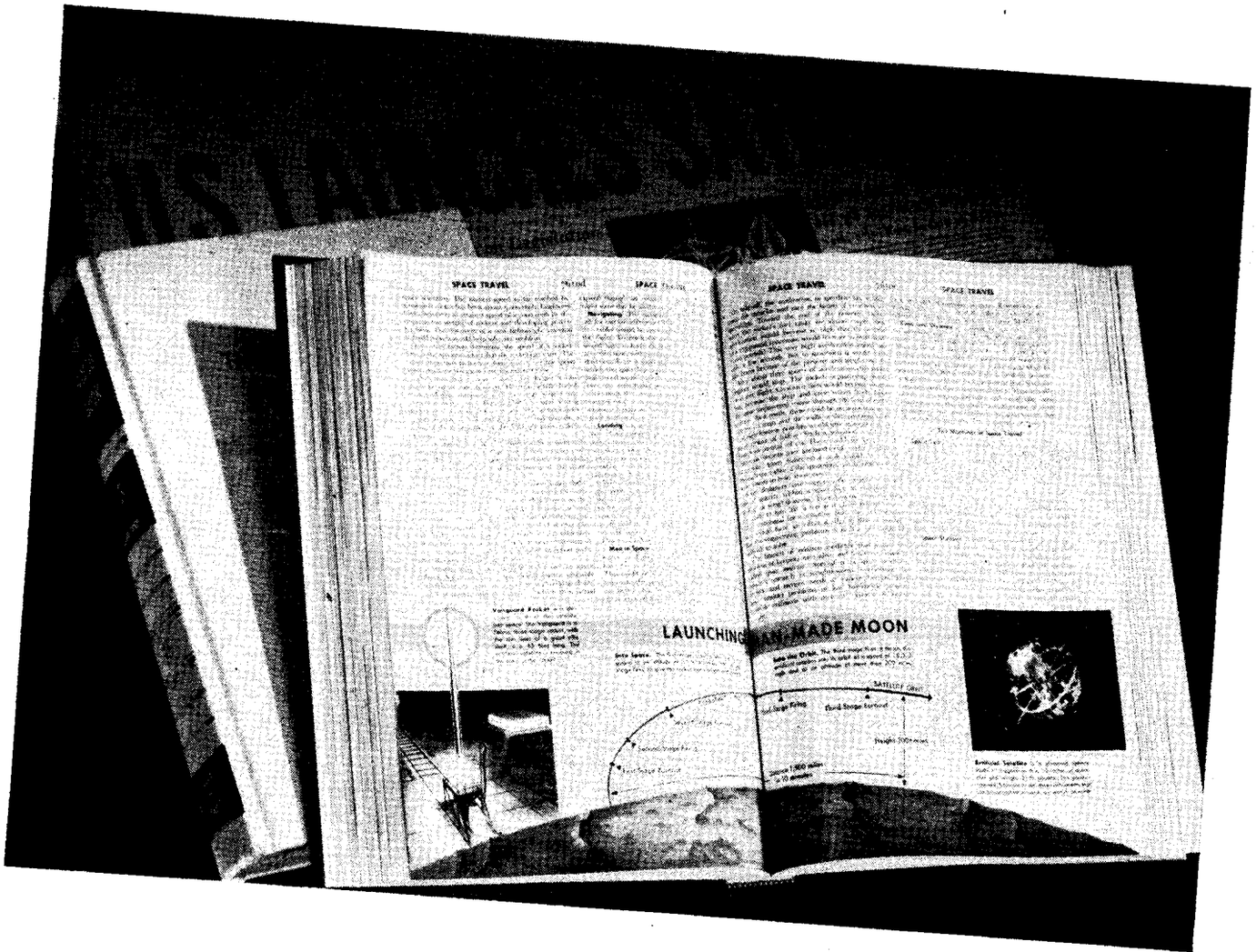


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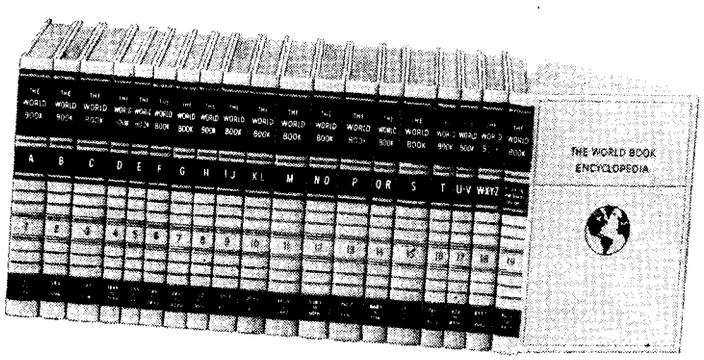


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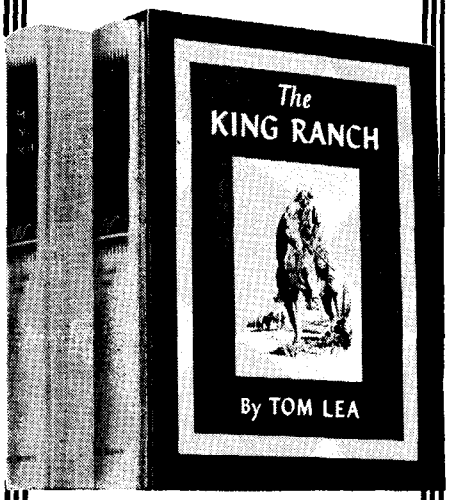


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## *Reader's Choice*

BY PHOEBE ADAMS

When Sam Johnson made his dictionary, lexicography was young and gay, and he dared to enliven his work with violent editorial opinions and wisecracks about the Scots. But the untrammeled doctor was succeeded by scholars with small humor and less nerve, who made solemn anonymity the rule of the profession. It's a pleasure to find BERGEN EVANS, the versatile English professor and television performer of Northwestern University, collaborating with his sister, CORNELIA EVANS, on A DICTIONARY OF CONTEMPORARY AMERICAN USAGE (Random House, $5.95), which is as personal as a hangnail but much more useful.

Since this is a dictionary of usage, no attempt is made to give pronunciations or to include every word in the language. The authors concentrate on trouble spots; their purpose is to define tricky words, give examples of unpredictable construction, and lay down a simple, practical system of grammar which explains English as it really is and not as a language that would be like Latin if only it were kept in better order.

The explanations of usage are clear and bolstered with ingenious examples. At their best, these include the word in question plus any other words which might be confused with it. A Pickett's charge on *bring* and *take* winds up, "Take that box and bring it with you, or if it's too heavy for you I'll send Joe to fetch it," which covers everything except the identity of Joe, who may or may not be a dog. The authors have great fun over the dangers of mixing *satisfy* with *convince* ("Despite the doubts of the police, his family was satisfied that he had been murdered.") but seem to have missed another nuisance, the interchanging of *convince* and *persuade*.

While omitting a great many meek, well-behaved words which have never bothered anyone, the authors include several equally harmless items for no reason but the joy of discussing them. *Gamesmanship* and its derivatives fill up a giddy column. *Incubus* and *succubus* are defined in detail, even to the charms employed to suppress them, the authors then confessing, rather guiltily, that "These distinctions no longer hold in standard, common usage, but the learned preserve them and delight in them."

There seem to be three principles underlying this work, two plainly stated and one tacit. The first — that language changes constantly and contemporary usage is precisely that — is sound and the basis of the whole book. The second, that all clichés are necessarily villainous, has led the authors to include a rag, tag, and bobtail (one cliché they missed) of slang terms, standard phrases, proverbs, and quotations which rain down like cats and dogs (cliché) upon the hapless student. In principle they are right, but in practice a lot of people would, if deprived of clichés, be unable to utter anything but the plainest of flat statements.

The third principle, which although never stated is implied in both the text and introduction of the Evans dictionary, is that anyone can write and speak well with a little application. This is something that all teachers of English, at any academic level, seem to believe and presumably will go on believing until someone contrives to demonstrate that the ability to control language is as much a gift as a talent for mathematics or drawing is, although mercifully rather more widespread. Congenital language-maulers will not be cured by the Evans dictionary, but persons in doubt about specific points will find the book very helpful, and no one with an interest in the whimseys of our native tongue can hope to resist it.

### LADDER TO NIRVANA

JACK KEROUAC'S second novel, ON THE ROAD (Viking, $3.95), concerns the adventures of the narrator, Sal Paradise, a war veteran who is studying on the G.I. bill and writing a book between drinks, and his younger friend, Dean Moriarty, late



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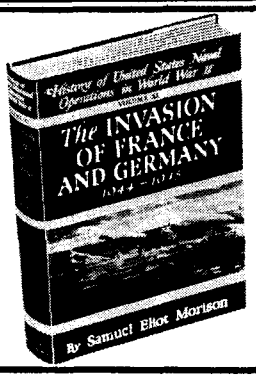


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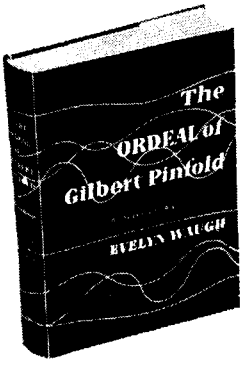


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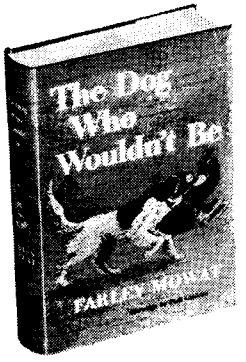


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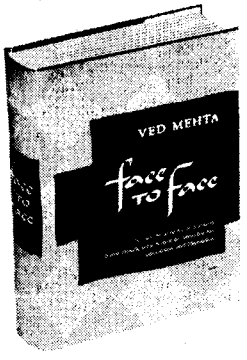


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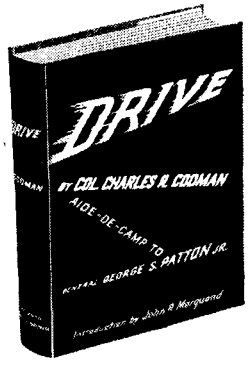


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of reform school. Neither of these boys can sit still. They race back and forth from New York to San Francisco, they charge from one party to another, they tour jazz joints, and Dean complicates the pattern by continually getting married. At odd moments they devote a little thought to finding Dean's father, a confirmed drunk who is presumably bumming around somewhere west of the Mississippi.

Dean is the more important character. Mr. Kerouac makes considerable play with his disorderly childhood, his hitch in the reform school, and his rootlessness, but his activities seem less a search for stability than a determined pursuit of euphoria. Dope, liquor, girls, jazz, and fast cars, in that order, are Dean's ladder to nirvana, and so much time is spent on them that it is hard to keep track of any larger pattern behind all the scuttling about.

The trouble is a matter of repetition. Everything Mr. Kerouac has to tell about Dean has been told in the first third of the book, and what comes later is a series of variations on the same theme. It's a good theme — the inability of a young man of enormous energy, considerable intelligence, and a kind of muddled talent for absorbing experience to find any congenial place for himself in organized society — but the variations are all so much alike that they begin to cancel each other out.

However, the novel contains a great deal of excellent writing. Mr. Kerouac has a distinctive style, part severe simplicity, part hep-cat jargon, part baroque fireworks. He uses each of these elements with a sure touch, works innumerable combinations and contrasts with them, and never slackens the speed of his narrative, which proceeds, like Dean at the wheel, at a steady hundred and ten miles an hour.

The book is most readable. It disappoints because it constantly promises a revelation or a conclusion of real importance and general applicability, and cannot deliver any such conclusion because Dean is more convincing as an eccentric than as a representative of any segment of humanity.

THE LORD HIGH EXECUTIONER

BRENDAN BEHAN'S play, THE QUARE FELLOW (Grove, $1.25 and $2.75), has already stirred up con-


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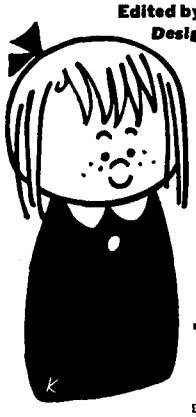

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siderable excitement in London, partly because of its obvious relationship to the campaign against capital punishment which has raged for some time in England. Regardless of this connection, *The Quare Fellow* is clearly a wonderful play, of the sort that arouses in the reader an urgent hankering to see it on the stage.

The action takes place in an Irish prison where a man is about to be hanged, and involves nothing but the usual shenanigans of the prisoners and their sporadic and on the whole casual references to the impending execution. Warden Regan and the hangman are almost alone in taking the affair to heart, yet the presence of the condemned man and the horror of his death pervade the play and grip the reader like an obsession.

Mr. Behan has a gift for dialogue which is remarkable even by Irish standards. His characters talk magnificently, and most of them have distinct personal styles. The one poor Englishman in the place, jugged on a smuggling charge, is utterly outdone, but even he has his own voice. Neighbor and Dunlavin, two old rascals devoted to horseplay and pilfering liquor, are a continual delight. Regan, on the whole a serious fellow, is capable of going off like a rocket when a prisoner offends him by appearing to prefer English jails. "There's the national inferiority complex for you," says Regan. "Our own Irish cat-o'-nine-tails and the batons of the wardens loaded with lead from Carrick mines aren't good enough for him. He has to go Dartmooring and Parkhursting it."

Under the flashing talk and the roughhouse comedy, *The Quare Fellow* makes a powerful case for human dignity and a fiercely effective attack on the brutality and stupidity of the prison system. It's a matter on which Mr. Behan is entitled to speak with authority, having served eight years in British jails for his exertions on behalf of the IRA.

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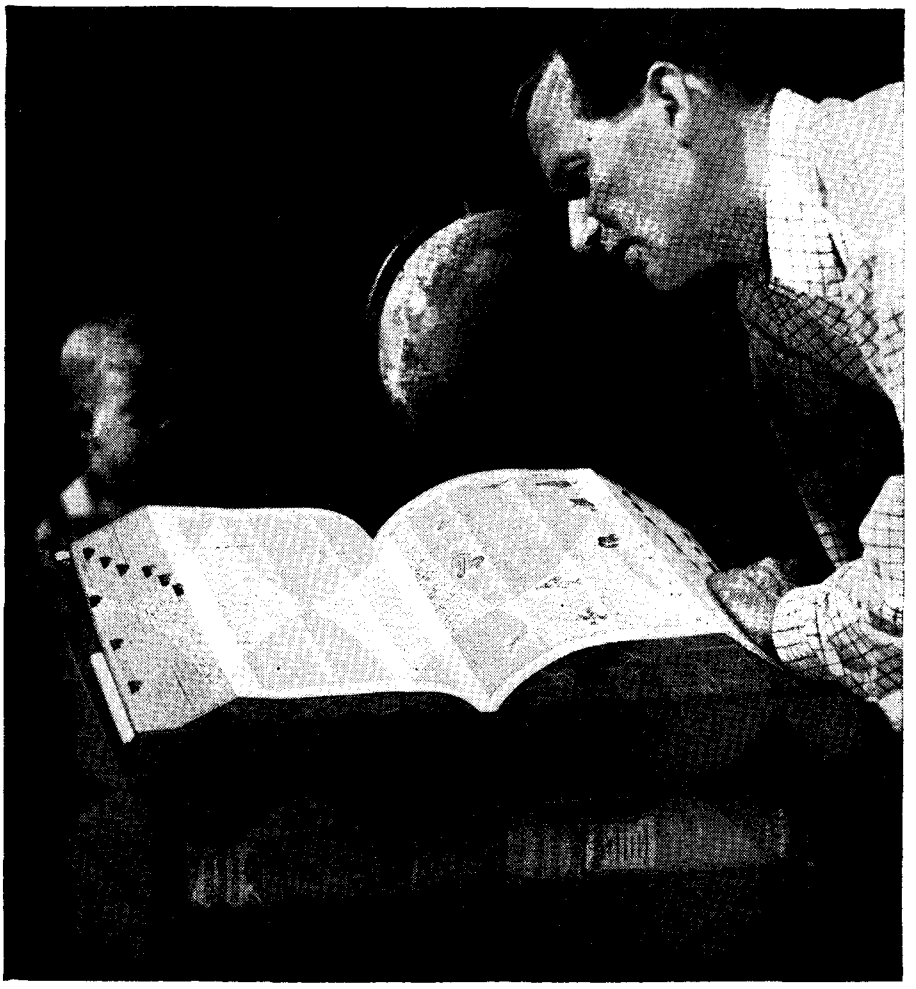
"A battle is exceedingly complicated," FRED MAJDALANY writes in chapter two of THE BATTLE OF CASSINO (Houghton Mifflin, $4.00) and then sets out to demonstrate that this is a monumental understatement. A sore point at the time, the long and costly operations at

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Cassino still raise the hackles of both observers and participants, and have provoked a good deal of snarling and clawing among military authors bent on justifying their own connection with this episode of the Italian campaign. Mr. Majdalany, who served at Cassino as an infantry officer, ostensibly has no official or personal ax to grind and is interested merely in making clear how the battle was fought and why it became necessary to fight it in that particular way.

Clarity about Cassino is no easy goal. Even on a map the terrain is discouraging, and following the routes by which various Allied units scrambled over the mountainsides requires close attention from the reader. Mr. Majdalany has done his best with maps and careful writing to make the series of actions comprising the battle comprehensible to a civilian audience, and considering the difficulties involved, he has done well. Only a large contour map with armies of pins moving about on it could really cope with the geographical complications of Cassino.

Mr. Majdalany attributes the initial weakness of the whole Italian project to the reluctance of the U.S. high command, which wanted no part of Mr. Churchill's Mediterranean experiments. The author is an Englishman and inclined to side with Mr. Churchill, but he does not let national loyalty blind him to the fact that the prime minister's "soft underbelly" estimate of Italy, however accurate politically, was nonsense from a military point of view. The place is a defenders' paradise, and the Germans, fighting a canny, methodical rear-guard action to the south, had plenty of time to dig themselves in like badgers at the natural fortress of Cassino. Coming up after a bungled landing and much hard fighting, the Allies arrived with insufficient troops and inadequate supplies and promptly got into trouble.

Mr. Majdalany has been very thorough in describing what happened to the troops on the spot, and why. It's an agonizing muddle of official disagreements, mistimed support (the Italian weather was partly responsible for this aspect of the Allied troubles), and inadequate preparation, for all of which the men at Cassino died. It is noticeable that the book contains very few specific episodes, almost none of those odd personal anecdotes that usually turn up in military histories. Halfway through his story, Mr. Majdalany apologizes for this deficiency, explaining that the lack of individual reminiscence is caused by the paucity of survivors.

The nature of the various troops that fought at Cassino — Americans, English, Sikhs, Gurkhas, New Zealanders — is described at some length, along with the characters of their commanders. Aside from a determined aversion to Mark Clark's more theatrical gestures, Mr. Majdalany views these officers with sympathy. They did not plan the campaign, and their complaints and protests were ignored by their superiors. The responsibility for Cassino, Mr. Majdalany concludes, rests with Mr. Churchill, who underestimated the difficulty of invading Italy and overestimated its value as a diversion, and with the United States officials who lacked the determination either to decline a venture of which they disapproved or to undertake it properly once they had agreed to it. One of the most distressing aspects of this distressing episode is the inconclusiveness of the whole business. One would like to believe that Cassino was worth it, but all Mr. Majdalany's evidence suggests that the German force theoretically diverted there wasn't going anywhere else anyway. To sum up the battle as "little more than a victory of the human spirit" is the ultimate depth of chagrin.

FICTION

The title of JULIAN GREEN'S latest novel, THE TRANSGRESSOR (Pantheon, $3.50), ostensibly refers to the predicament of a homosexual trying to follow his own bent without involving the respectable, normal relatives whose house he shares. As the story unrolls, however, the title becomes ambiguous, for the central character proves to be the young cousin, Hedwige, and all the action develops from her ignorant infatuation with one of Jean's perverse friends. One is left wondering who is really the transgressor in Mr. Green's eyes.

Mr. Green has a peculiar capacity to conjure up an atmosphere of hazy danger, full of sibylline hints and portentous shadows. He also has a slight predeliction for innocent young girls crushed by the estab-



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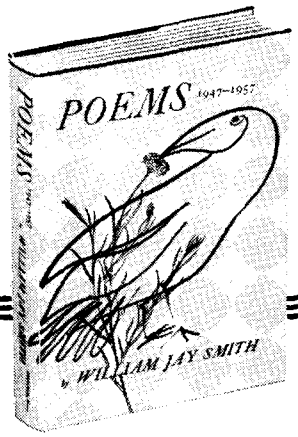


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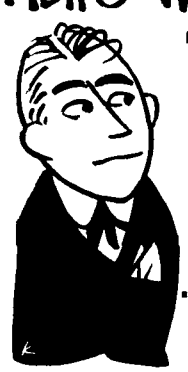

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lished corruption of the world. Both tendencies are given full play in *The Transgressor*, and while the events of the novel will not bear the most careless scrutiny of common sense, it is successful on its own strange level. The story that Mr. Green tells can hardly have been intended to represent external events in a stuffy French provincial town. It is rather a translation into blunt external events of psychological patterns which ordinarily would come into the open only in disguised or distorted form.

The technique comes close to being a reversal of what is usually considered the myth-making process, and with it Mr. Green illogically achieves something of the haunting overtones of myth. Within his closed world, his characters ring true and act consistently, and every detail is deftly selected to support them and hold the reader immersed in a universe of stylized evil.

LALAGE PULVERTAFT'S THE THING DESIRED (Viking, $3.50) is a much more orthodox novel, centered on the interlocking relationships of a group of people who are just far enough out of the ordinary to be interesting. Miss Pulvertaft provides a proper heroine, a redheaded, ginger-tempered beauty; a Byronic hero, suitably modified for this psychiatric age; and above all, a villain. He is not, of course, a conscious villain; that would be too much to expect. But as self-righteous, sweetly bullying villains go, Adam is highly satisfactory.

The subsidiary characters have considerable vitality, though no particular depth, and keep things rolling along briskly with a variety of unconscious absurdities. Miss Pulvertaft evidently subscribes to the old belief that dialogue should be amusing even in a story of fairly serious intent, and she refuses to indulge her people in drearily realistic conversation. Even the soulful metaphysics of Adam and the redhead contain sparks of ironic humor, although they themselves don't know it. All the proceedings at the inferior school where Caroline is a desultory teacher are sharply funny. The damp-eared intellectual climber who introduces her to Adam (the fellow is a critic of vast reputation and no performance worth mentioning) is a fine, wicked sketch.

*The Thing Desired* is Miss Pulvertaft's second novel, more ambitious

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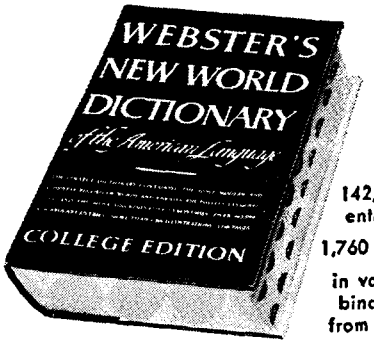


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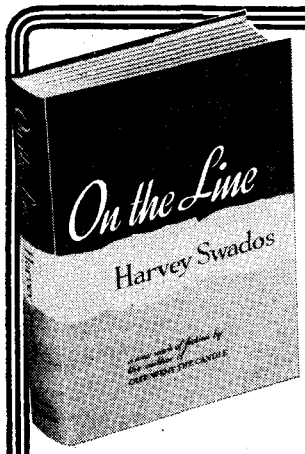


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than her first and neatly carried off. The plot, the havoc which a destructive temperament can cause among unsuspecting lovers, is nothing new in itself, but the author handles it with skill and works up plenty of tension.

VOSS (Viking, $5.00) is by PATRICK WHITE, who wrote *The Tree of Man*. It is a large, slow novel set in nineteenth-century Australia and concerned with a German fanatically bent on exploring the back country. A great deal of attention is paid to social activities in Sydney, where Voss must beguile rich merchants into backing his scheme, and to the mixed crew of scientists and amateurs who ultimately make up the party. There is a remotely intellectual, or perhaps spiritual, romance with Miss Laura Trevelyan, a girl who certainly goes at everything by the briary path. When the exploration finally gets under way in the outback, there's a certain amount of to-do and local color, ending in the apotheosis of Voss and the dedication of Miss Trevelyan to education and culture.

Anyone who assumes from this summary that I do not care for Mr. White's book is quite correct. It is a jumble of social comedy, inflated romance, and frontier adventure, and in covering all these forms the author has suffered the traditional fate of the Jack-of-all-trades.

The prose is thick with pointless oddities of a vaguely archaic turn, *did but's* and arbitrarily placed *which's*. Characters frequently sense things that might better be guessed, suspected, or even smelled. Mr. White has a maddening habit of beginning a sentence with all the symptoms of one about to confide something subtle, or important, or both, and ending it with a revelation as obvious as a black eye. "If the more sensitive among those she served or addressed, failed to look at Rose, it was because her manner seemed to accuse the conscience, or it could have been, more simply, that they were embarrassed by her harelip." It certainly could.

If this novel is anything more than a literary all-day sucker, the fact has been completely obscured by pretentious stylistic wrappings.

GOVERNMENTAL RED TAPE

PARKINSON'S LAW (Houghton Mifflin, $3.00) is a small, hypocriti-



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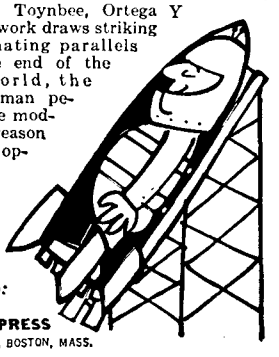

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cally demure-looking book in which PROFESSOR C. NORTHCOTE PARKINSON, "dismayed to realize what other people suppose to be the truth about civil servants or building plans," undertakes to enlighten "the reader of discrimination" with the results of years of scientific investigation "not merely of an admittedly gifted individual but of a vast and costly research establishment." Essentially a modest man, Professor Parkinson does not claim to have dealt with all aspects of administration. "The recent discovery in a certain field of warfare that the number of the enemy killed varies inversely with the number of generals on one's own side has opened a whole new field of research."

Like most deliberately funny books, *Parkinson's Law* is better read in snatches, a chapter here and there; besides, anyone who truly appreciates Parkinson is sure to have the book reft from him by housemates.

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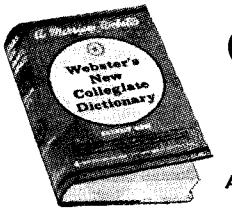


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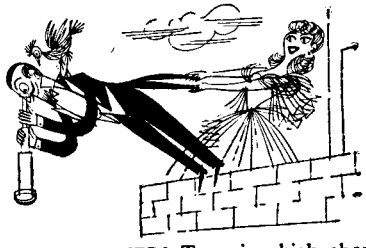

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but guaranteeing that the populace will mount the revolutionary barricades. As an anthropologist, he assists with the Meddleton-Snooperage report on Chinese coolie-millionaires, which has interesting connections with discoveries on the Upper Teedyas River, Darndreeryland.

Professor Parkinson really is a scholar and the survivor of certain collisions with the British government, and his mastery of pseudo-academic and quasi-official prose is complete. This style, with its effect of communicating matters of the first importance, puts the final polish on the satirical irreverence of *Parkinson's Law.*

### A PLEA FOR THE STATUS QUO

Alarmed by what they believe to be the inevitable Europeanization of Africa, PAUL BOWLES and PETER W. HAEBERLIN have put together a book called YALLAH (McDowell, Obolensky, $10.00). Mr. Bowles has written the short but impassioned text in praise of traditional ways and primitive simplicity, while Mr. Haeberlin's splendid photographs are calculated to make anyone pack up and head for the Hoggar.

The territory covered runs roughly from interior Algeria south and east to Lake Chad, and it includes a great variety of landscape and people. Mr. Haeberlin is a superb photographer, equally adept with great desert vistas and close-up portraits, and every picture in the book is fine.

Mr. Bowles compresses a great deal of information into his introductory text, but his fear that European influence will destroy all that is worth while in African life without supplying anything of value in its place leads him to omit much that one would like to know about the present in favor of romantic memories. He pines for the days when In Salah was a trading center for "ivory, ostrich plumes, panther and lion skins, rhinoceros horns, gold-dust, incense, and slaves" to such an extent that he forgets to explain the rather surprising presence there, today, of a municipal swimming pool.

No one can quarrel with Mr. Bowles's intentions, though, for he wants only the best for a country that he dearly loves. It is to be hoped that this enchanting book does not counteract the purpose of its makers by enticing an influx of tourists to demoralize the place.

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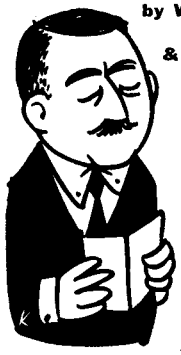

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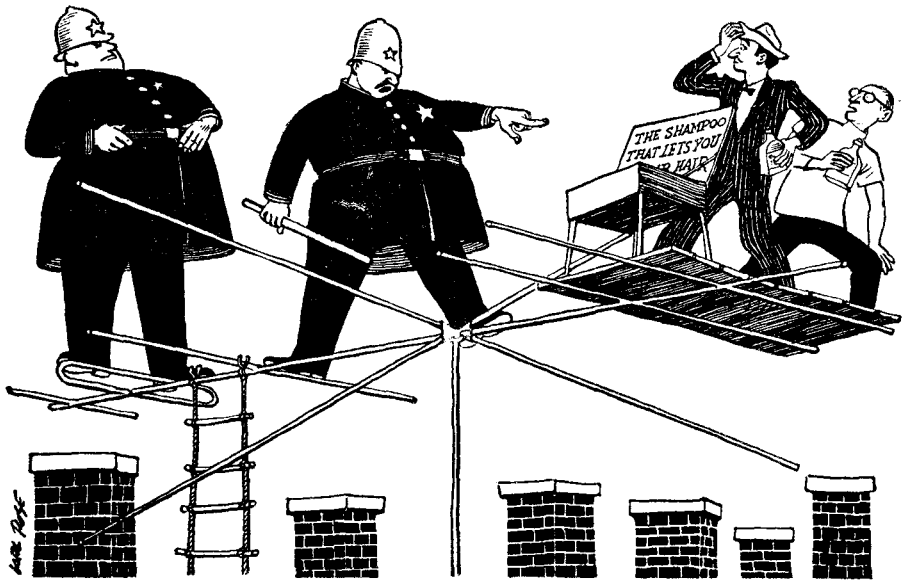


# Accent on

The Federal Trade Commission has been issuing "complaints" recently against certain television commercials. Some of the statements made on the airwaves — not all, of course — verge on the extravagant, the Commission is discovering. One assumes the Commission had no TV set prior to the spring of this year, but it appears to have taken advantage of the low prices and the ridiculously easy terms and bought one, with the result that since May 15 it has issued no less than six complaints, two of them against shampoos. This does seem a rather small bag, but the FTC was never the agency for headlong action, and its monitoring unit is still new at the grim business of ferreting out hyperbole in shampoo announcements, if that is what they can be called. As the New York *Times* story put it: "Slowly, the unit has gained eyes as agents are assigned to spend time before television screens and radio sets." So, after being more or less deaf to radio for almost forty years and blind to TV for a decade, the FTC is now on the prowl for the delinquent commercial.

One of the first to be unearthed by the FTC sleuths was "Helene Curtis Industries, Inc.," which used "scare tactics, alarming and frightening beauty-conscious young girls by audio-visual representations to disparage competitive shampoos." The "scare" in this case consisted of telling these "young girls" — and everyone else, one supposes — that certain other types of shampoo would "burn the hair."

It is odd to find a shampoo company and its copy writers falling into such a trap as an explicit statement, possessing some meaning, to which the FTC could object. Any TV watcher could have told them that the successful commercial, no matter how scary or false or preposterous its implications, is always meaningless. One of the most conspicuous shampoo commercials is really nothing but flurry and uproar in the audio and a few quick flashes on the screen that come and go so fleetingly that no one can be sure just what he has seen.

The meaningless shampoo commercial begins with an announcer shouting at the top of his lungs something about a woman whose hair is "five times lighter." On the screen, facing away from the camera, appear two women. They are ornately waved and curled, and just as the viewer is deciding that both look alike, an arrow or legend indicates that the woman at the left is the "five times lighter," but before this can be examined as a fact, the picture vanishes. The announcer continues shouting "five times lighter," and we are confronted by what seems to be a close-up of a light meter, whose indicator is jerking all the way across the dial, apparently just from being in the same studio with the "lighter" coiffure, which, incidentally, never does look "light." No "than" ever follows the "five times lighter," and it remains at all times what William Johnson, Boston correspondent for *Time*, has termed "the dangling comparative."

There comes to mind also the commercial about the wonderful white paint that actually looks white when the camera eyes it, in appalling contrast to other brands of white paint which — so the camera shows us — turn odd colors and begin to flake and peel almost before they have dried. A meter or gauge of some kind is used to reinforce the declarations of the announcer, and here again is the proposition that any movement of an indicator across a dial is proof positive that what the man is saying must be so. The formula is simplicity itself: Just keep on bellowing the same statement, while a needle is made to twitch across the dial or a column of mercury to race up or down in a tube. ("The cane you ring is the cane you win!")

At this early stage of its enlightenment, the FTC may be unaware of the TV and radio commercials


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in which a worried woman begins a question with the words "Tell me, doctor," only to be answered not by a doctor of anything whatever, but by an actor who explains learnedly the complex physiological blessings to be gained from stopping "taking whatever you are now taking" and beginning regular dosages with a pill made by the actor's employer. What makes this commercial practically honest is that the actor does not call himself a doctor, it's the woman who does, and that's just her hard luck, poor ignorant creature that she is. Some of the "doctor" commercials on TV have become so honest that the actor has even put aside the doctor's white coat and appears in an ordinary business suit, although the interview still takes place in what TV producers believe a doctor's office looks like.

Even more honest is the commercial with an actor in a *gray* smock or duster, who talks about queer chemical reactions that show his employer's product is superior to others. He proves his point by causing a glass flask of the competitor's product to turn into a horrid murk, while his employer's remains clear as a bell, but this actor never admits that he's a chemist and nobody calls him one. What could be more honest than that?

But scruples of this sort seem commonplace when compared to the prodigious lunge toward business piety announced recently in a compact between the Chicago *Daily News* and automobile dealers. Between them they created an "Honestly Advertised Car Code," and when one reads the three principles laid down in this renunciation, one can see readily just what automobile advertising in Chicago must have been like before the adoption of standards almost puritanical in their rigors. In the new arrangement, described in *Editor & Publisher*, the newspaper requires the dealer to sign a statement that he is complying with the code:

"1. Honestly described. Any description given in an ad by a dealer on a specific automobile will be accurate." (The attempt here is to hinder dealers from putting into their advertisements statements that are absolutely not so.)

"2. Honestly advertised. Any car advertised will be at the location advertised on the day of publication, or a bona fide bill of sale will be in the possession of the dealer to account for the absence of any car." (The dealer covenants not to advertise for sale a car that he does not and never did possess — that is, a car that doesn't exist.)

"3. Honestly priced. When full selling price, cash or terms are mentioned in a dealer's advertisement, it will be the amount the car will be delivered for, except for taxes and license fees." (There are other ways of interpreting "honestly priced," but in this case "honestly priced" simply means that the price quoted in the advertisement is the actual price.)

CHARLES W. MORTON

# *Table Talk*

BY **R. G. G. PRICE**

R. G. G. PRICE *lives in Sussex and has contributed much light writing and literary criticism to* PUNCH. *He writes for the* ATLANTIC *on a variety of subjects.*

One evening a man I wanted to impress with my conversation took me to a Spanish restaurant. I did not know the language, so I chose from the menu at random. When the sweet came it was about a quarter of a pound of nougat and you were apparently expected to eat it with a tiny fork.

Nougat is good stuff if you can tear away at it in private, calling, if necessary, on the resources of a Home Repair set; but it does not go with good talk. My mouth was already dry after some desiccated and salinated fish. The nougat swelled and I could feel it taking an impression of my teeth, while my host popped little soft pink things into his mouth and asked me about the modern French novel. I tried to look quizzical but I must have looked befogged. He changed down and talked about the cost of living. When I regained the freedom of my mouth it was too late.

Traditionally wit and gastronomy go together, but the mechanics of the partnership are puzzling. The Greeks and the Romans, who worked on problems like the immortality of the soul at banquets, made things even harder for themselves by lying twisted on couches, a posture that is practical for asparagus on the stem but not for the kind of food that was actually served, as it is described for us by satirists flaying gluttony. Ancient food sounds as though it would generally have needed a strong downward thrust. Just try eating a lamprey while saying, "If now, wonderful Thrasymachus, injustice be in one, whether does it lose its power, or will it no less retain it?" — and this, at least according to Spens's translation, is how the Socrates set talked at meals.

At modern banquets, you get halfway into a chain of witty paradoxes when you find that a waiter is holding a dish of interconnected food behind and above your left ear, and by the time you have served yourself your audience has broken away. Once the food is safely in front of you, you have to keep darting looks in two directions: at your hearers, to add the power of the human eye to the hypnotic effect of your words, and at your fork, to make sure you are not ludicrously lifting it bare. The old phrase "the flow of soul" suggests an effortless, carefree outpouring, but to obtain this effect while unpicking an ortolan is *acting*.

Of course, the wit will have learned as a child not to talk with his mouth full, and perhaps wish that he had learned how to. Eating, like breathing while in song, must take place during natural pauses. The trouble is that what seems a natural pause to one wit may strike his rival as a heaven-sent opportu-


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nity for getting into the act. One can work through a mouthful of omelet or mousse during a laugh easily enough or, if the conversation is philosophical, while the company are grappling with a question about Being or Knowing: the pause can be momentary. A mouthful of old steak, on the other hand, may mean a silence so prolonged as to amount to abdication.

Of course, once the solid stuff has been bulldozed and the port and nuts and brandy and cigars are circulating, the wits and sophists get a clear run; but by then the ear of the table has been caught, not by the adroit talkers, but by the adroit eaters. A man who holds back his repartee until after the cheese might as well save it for another day.

I have been talking as though all conversation took place at dinner. During the nineteenth century, however, there was an inexplicable vogue for conversational breakfasts. Wits and gossips like Crabb Robinson and Samuel Rogers were prepared to serve their guests heavy meat meals soon after dawn. The characters in Oliver Wendell Holmes talked on the oddest subjects at the breakfast table. This, of course, was before the time of the modern cereal, whose pops and crackles would soon put an end to any rational discussion. Today breakfast is essentially a solitary meal that goes with the private reading of a newspaper. It is true that in many homes it is lifted into frenzy by the presence of children; but in an ideal world, breakfast would be a time of gentle self-communing. In any case, it is not a suitable setting for the kingfisher swoop and scorpion sting of good talk.

How did the legendary table-talkers manage? I suppose that Coleridge's opium would have reduced his appetite and he probably improvised his iridescent metaphysics undistracted by hunger. I wonder whether his audience took opiates too. Macaulay apparently never stopped talking at all. He sounds a full-blooded, healthy man and not a starveling, and he probably had a nourishing meal before he arrived at Holland House. Perhaps once there he was served with stage food just to keep up the illusion.

Oscar Wilde had the figure of a good trencherman, and I find it difficult to believe that, however much he had laid down before he came, he sat nibbling olives and sipping wine while fashionable London guzzled. I suppose he had established such command of his hearers that he could break off in the middle of a conversational cadenza for a second helping and find them waiting patiently when he was ready to resume. Whistler, on the other hand, had the soured attitude to life of a man on a diet. There is a research thesis waiting for somebody on the effects of dieting on conversation, ditto vegetarianism.

One advantage that the host has in these mixed battles of food and words is that he can rig the menu. He can have himself served with mock lobster while the guests have lobsters that seem to have had their meat glued into their shells. It should not be impossible to work out ways of making macaroni easy for the man with the know-how but as good as a gag for the common diner. I cannot remember whether Lucrezia Borgia had conversational ambitions. If she had, she would have been just the hostess to include spices that paralyzed the vocal cords while stepping up acuteness of hearing. Many a wit must have founded his career on fixing a cook or a waiter. In fact, I am beginning to wonder whether the Spanish word on that menu really meant nougat after all.

• • • • • • • • • • • • • • • • • • • •

## COMMITTEES

BY JOHANNES GAERTNER

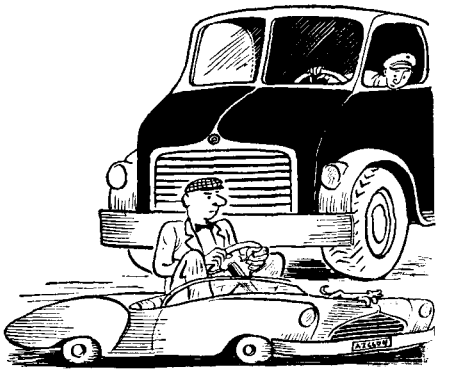
A man is a man is a man
and he does what he can,
but a Committee is a Committee
and a Committee, methinks, never
can.

• • • • • • • • • • • • • • • • • • • •

# *The Cougair X3*

BY LESLIE MELLICHAMP

*A Southerner who was educated at Clemson College to be an engineer,* LESLIE MELLICHAMP *now teaches English at Virginia Polytechnic Institute.*



Of interest to sports car enthusiasts was the recent announcement of the Cougair X3. The model incorporates all the features that sports car buyers have come to expect, plus a number of rather outstanding innovations. The X3 is beginning to attract discriminating buyers in increasing numbers throughout the country.

One of the more dramatic departures from standard automotive practices is Cougair's elimination of the springs and shock absorbers that form the backbone of the conventional suspension system. To achieve a lower center of gravity and eliminate extra weight, the X3's wheels are, in effect, bolted directly to the frame. The effect of this change is rather startling to the driver accustomed to conventional suspension: the sponginess of ordinary springs and shock absorbers is replaced with a new firmness; "road feel" has been tremendously increased.

Although high horsepower is standard equipment on most new cars, the X3 has more than double the power expected in a car of this class. The increase has been brought about by the use of fuel injection — with a difference. Only part of the gasoline is actually burned; the remainder is expelled at high speed from the jet-type exhaust, giving the car added thrust. Such a system does not, of course, result in maximum gasoline economy, but all will agree this is a small point when



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compared with the real he-man performance of the X3 — performance further increased by the use of an extra 1¾-inch gas line that cuts in when the accelerator is pressed to the floor. At any rate, the expulsion of raw gasoline from the exhaust as a device for obtaining forward motion of a vehicle is certainly something new in the annals of transportation, and poses many exciting possibilities.

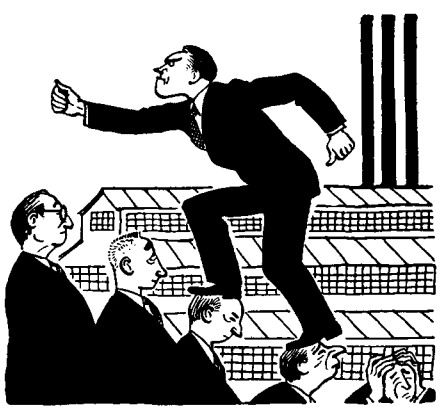
A greatly reduced car height cuts wind resistance to the bone and gives the X3 startlingly low, sleek lines. The reduction in height naturally cuts somewhat sharply into the interior space; in fact the driver must sit almost bent double. As a result, some drivers have found it easier to look between their legs, rather than over their shoulders, when backing the X3. Actually, it has been shown that the human body can better withstand the shocks of high acceleration and sudden stops in this position, so the "tight" interior space has much to commend it. Those who might complain of the cramped quarters should be reminded that the X3's reduced height adds 3.2 miles per hour (sea level) to the car's top speed.

Although the new suspension, the injection-expulsion engine, and the low profile constitute the major innovations of the X3, the car incorporates many minor changes and additions that would seem to enhance its value. Space permits the mention of only one — one that incidentally fills a much-felt need. In addition to the usual engine tachometer, the X3 provides accessory tachometers, which tell at a glance the revolutions per minute of the generator, the water pump, the distributor rotor, and the windshield wiper motor. All in all, the Cougair X3 looks like the surprise car of the year.

# *Rough Deal*

BY WILLIAM L. COPITHORNE

*A writer and former teacher of English,* WILLIAM L. COPITHORNE *is now a businessman in New York.*



Businessmen are at last coming into their own. Long neglected as subjects for fiction in favor of men with more titillating occupations — brain surgeons and nuclear physicists, for example — they now bob up regularly in best-selling novels and prize-winning television plays. That the average businessman is hard put to recognize himself in these works is to be expected. Doctors and scientists have experienced the same bewilderment for years.

Actually, though, the businessman is getting a rough deal. Whereas professional people are most often portrayed as essentially noble souls — devoted to humanity if not to their wives and children — the businessman is granted few of the higher qualities. No dedicated Dr. Arrowsmith, he. No doted-upon Mr. Chips. He is never a man called Peter. At best he is an individual of limited vision, so obsessed with the notion that the business he is running should pay dividends to stockholders, that he has no time for his family and friends or for great literature and fine music.

Often he is a self-serving schemer, intent on discrediting those who stand between him and the presidency of the great corporation. Business, it is clear, instills false values in a man, dulls his moral sense, and makes him insensitive to those things of the spirit which his brothers in the professions have both the time and the inclination to embrace.

In general, the businessman fares better in the television play than in the novel. This is doubtless because the theme of redemption lends itself so well to hour-length dramatic treatment. Here the businessman most usually appears as a powerful but seriously misguided person. In the course of the play he unconsciously, perhaps, hurts someone he loves. He is thereby made to suffer, and is thus awakened to the error of his ways. For years this formula has proved successful on both radio and television in stories about murderers, thieves, and dissolute sons of loving families. Now it appears that it can apply equally well to the American businessman.

Henry Stickney, for example, has singlehandedly built the Turfside Glue Works into a 27-million-dollar-a-year enterprise, and we see him in the opening scene surrounded by deferential employees, admiring the rising curve on the sales chart. He has made a lot of money and given steady employment to hundreds of people in the community, but all is not well. "Your business has swallowed you, Henry," his wife says, as he arrives home late in the evening after having forgotten for the fifth time that month his promise to take her to the Art Theater. "Your business has swallowed you, and it is now in the process of digesting you." (Dialogue of this kind — repetitive, broken by pregnant pauses, and accompanied by meaningful glances — is peculiar to plays which run for sixty or ninety minutes on the television screen.)

Henry refuses to change his ways, however, and he keeps on working late at night, improving productivity at the glue works, until suddenly the means of redemption are given him. His son is badly hurt in a drunken brawl on the same evening that his daughter runs off with a man twice her age — both tragedies the result, it is made clear, of Henry's absorption in the glue works. Earlier that same evening his wife has left him, after penning a note to the effect that money is not all. Henry returns to an empty house and, in a scene that may last from one to three minutes, wanders miserably through the rooms that are filled with the symbols of his material success, while appropriately somber music is heard in the background. (A matinee idol of a generation ago usually takes the part of Henry, and this scene gives him an opportunity to exercise certain of his histrionic talents that have long been decently at rest.)

Suddenly Henry grabs a silver-



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handled cane, takes a wild swing, and sends a huge vase crashing to the marble floor, and we realize that understanding has come to him. He is redeemed. His wife, apparently having thought better of what she said about money, comes rushing in at that moment all forgiveness. The glue factory, she can see, has disgorged Henry. The son, we know, will not die; the daughter's marriage can be annulled; and perhaps even the vase can be stuck back together again with some of Henry's glue. We can stay tuned for the eleven o'clock news with good heart.

Why the makers of processed cheese, electrical appliances, aluminum, and wax go on year after year footing the bills for plays that picture them and their brothers in trade as in need of redemption is a mystery that, for the peace of mind of all concerned, is perhaps better left unexplored.

With a recent notable exception or two, the novel presents a far bleaker picture of businessmen than does the television play. This is because the novelist not only knows that the businessman is beyond redemption, but has the space and time to show why. With 300 pages or more to spread out in, he can illustrate in full detail the dread effects that a competitive economy has on one of its practitioners. Furthermore, unlike the television dramatist, who has an audience that he knows is more than half tempted to turn to Red Skelton, he is under no compulsion to have his characters break vases or indulge in scenes of noisy hysteria which must, of course, mean a change of heart.

Henry Stickney, in the hands of a novelist, always ends up a lonely figure behind a great walnut desk, son dead and daughter and wife lost to him forever. And we are shown why he had such a fate coming to him. We learn how ambition corroded him early — how, while an apprentice in the horse-slaughtering yard of the glue works, he suffered a brief, unrequited love for the daughter of the Chairman of the Board, and then how he quite cynically married the daughter of the Works Manager; and how he gained the presidency of the company at the age of thirty-two by stepping on kindly men all up the line who had innocently helped him rise. And we almost certainly learn of an affair that he had with a girl of foreign extraction on the night shift in the bottling plant — a further indication of his moral degradation.

Passion for Money and Power and indifference to Art and Love mark the businessmen we read about in novels, and for such mistaken passion and such callous indifference they pay heavily. If they do not die early of ulcers, they live to be lonely, frustrated, bewildered men. The villain, of course, is our American economic structure, which inevitably maims those who strive to climb to a high place in it.

It is good to be reminded in the novel and television play of the existence of the businessman in our society, even though he may bear little resemblance to any human being we have ever known. It would be nice, though, just for once to be presented with a fictional businessman who spent a fair amount of time pleasantly with his wife and children, who read a book now and again, and who even went unprotestingly to an occasional concert — just as it would be nice to be told about a nuclear physicist who was tortured more by some foolish investments he had made than by his role in determining the fate of humanity in the age of the atom.

## NOTATION IN HASTE

BY ELIAS LIEBERMAN

Miss Brown, before these walls unquote
A phrase of fate and crush us both,
Please take a note to Me Inside,
Dissatisfied:

I am the man on a curtailed budget,
Entrepreneur for a plastic gadget
Made to suit either giant or midget.
Radio and television
Shepherd the crowd to the right decision
And hundreds of infidelity stations
Clutter my folds with public relations.

But what am I doing and where am I going
At a pace that is always *frenetico*,
*Molto, molto frenetico*
To a goal beyond my knowing?

Where is the image I lost while running?
Where is the way and the ten directions?
Where are the signs at the intersections?
Followed by creditors ever dunning,
I must get there, running, running
Faster, faster, ever faster,
Playing the game of follow-master
Straight to the edge of the next disaster.

Where should you file this? Come, Miss Brown,
Smell the smoke? There is time to burn,
So say the clocks around the town:
I am the Whom It May Concern.


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# *Mal de Vers*

BY FREDERICK PACKARD

FREDERICK PACKARD *has traveled widely and written several articles on the peculiarities of various languages. He is a member of the* NEW YORKER'S *staff.*

I read recently, I cannot remember where, about a man who tried to translate "Break, break, break,/ On thy cold gray stones, O Sea!" into French, and upon getting "Cassez, cassez, cassez,/Sur vos froids gris cailloux, O Mer!" gave up the whole project. Thinking of this, I decided to see how I would make out with some other classics. I have no idea if there are any French translations of these verses; certainly I never read any, but the professionals must get a lot of the sort of dumfounding stuff that I got before they work out an adequate, publishable translation — though it is surprising how often the stanzas rhyme accidentally, or fall just grimly short of it. I chose something simple but flamboyant to start with: "O Captain! My Captain!"

O Capitaine! mon Capitaine! notre
effroyant trajet est fini . . .

I went no further. I was afraid I might be getting into something subversive. Next I tried "Xanadu."

En Xanadu a Kubla Khan
Un majestueux dôme de plaisir décrété:
Où Alph, le fleuve sacré, coulait
À travers cavernes immésurables à
l'homme
En bas vers une mer sans soleil.

This was so horrible that I didn't feel like continuing. Note the accidental and dissonant triple rhyme. After trying to render Wordsworth's famous sonnet (Le monde est trop avec nous; tard et tôt) I had to go and lie down for a while. It produced lines such as

Afin que je puisse, restant debout
sur cette jachère plaisante,
Avoir des visions momentanées qui
pourraient me rendre moins morne.

Byron's "The Isles of Greece" buoyed me up a little. It had a certain *élan* to it in spite of some dreadful internal rhymes. Again, a fortuitous triple rhyme.

Les îles de Grèce, les îles de Grèce!
Où brulante Sappho aimait et chantait,
Où poussaient les arts de guerre et paix.
Où Délos surgit et Phébus bondit.
Éternel été les dore encore
Mais tout, à part leur soleil, est couché.

Reckless with irresponsibility I tried the opening stanza of Keats' "Ode to a Nightingale" and came near tears when I realized what I had done to it:

Mon coeur me fait mal, et une torpeur
assoupie me fait de la peine . . .

Feeling that I should at least make an attempt to get away from outright desecration, I next worked on "The Night Before Christmas":

C'était la nuit avant Noël, quand
à travers la maison,
Pas une créature remuait, pas même
une souris.

(Don't ask me why all mice, regardless of sex, are feminine.)

I am including "Hail to thee, blithe spirit" because it contains a zany unintentional rhyme — the finest example of what happens to our language under these circumstances so far:

Salut à toi, esprit folâtre!
Oiseau tu ne fus jamais
Qui de paradis ou de tout près
Verses ton coeur plein
En refrains prodigues d'art im-
prémédités.

But enough, enough. Here I decided I was not accomplishing my purpose, whatever that might be. So I shall revert to Coleridge for my envoi; this almost atones for the other barbarities, but is an equally fortuitous translation:

C'est un ancien marin
Qui arrête un de trois.
"Par ta longue barbe grise
Et ton oeil étincelant,
Pourquoi arrêtes-tu moi?"

Rather jaunty, isn't it? And a real rhyme, accidental or not.

## WHO?

BY LYSANDER KEMP

The moon says it is midnight. It is
Midnight, or half past eleven, or a quarter of two.
The insomniac owl in the old broken oak
Is asking, "Who?"

You know how it is, as the little hours
Bulge towards three,
And you try to remember who borrowed the stepladder,
Who shot Garfield, who wrote "The Sands of Dee."

The owl glares at the moon. The moon says,
"It was not me, anyhow." "True, true,"
The owl says, cleaning his bifocals while
Deploring her grammar. "But who?"

I am almost asleep. It is much too late
To offer a suggestion,
But I will sleep on the problem, and in the morning
Tell him the answer, if I think of the question.



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# How to Read

BY H. F. ELLIS

H. F. ELLIS *is a Londoner whose light prose has frequently appeared in the* ATLANTIC. *He is the author, also, of an extraordinarily funny book,* THE VEXATIONS OF A. J. WENTWORTH.

The way to get through this piece with the minimum waste of time is to avoid unnecessary eye movements. The average reader spends about 90 per cent of his total reading time in shifting his eye along the lines, not realizing that while the eye is moving, it cannot assimilate words. So what you have to do is to train yourself to take in the maximum inchage of print at each shift. A line at a glance is not too much to ask — certainly in this part of the magazine. The earlier pages, where the writers need three-inch-wide columns to make themselves intelligible, should be left to more experienced readers.

I got this tip about eye movements from an article called "You Could Read Faster" in a scientific journal, which I was toiling through in the old time-wasting way, and I hasten to pass it on. From an author's point of view, the quicker the reader can finish his stint and get back to his housework or money-making, the less likely he is to bear a grudge.

Some people have the pernicious habit of going back two or three lines — perhaps to the beginning of a sentence, or even a paragraph — to find out how the devil all this confusion of thought (or, it may be, of syntax, if the writer keeps injecting parentheses and subordinate clauses and suchlike bric-a-brac into his work) they've got into started. "A device which is useful in overcoming this," the article states, "is a shutter which can be made to cover the page at a predetermined rate, so that there can be no going back."

What this shutter costs, and whether it is portable for use in trains or has to be plugged in like a washing machine, I don't know; either my informant failed to mention these points, or I was going so fast at the time (being a little on my mettle) that they escaped me. But this I do know. If I had had some such device during the time I was reading Kant and Spinoza and that lot, I should have got through twice as many philosophers in the time and might be a Hegelian to this day. All we had in the way of reading-aids in the primitive nineteen-twenties was a plain wooden ruler, and even that I used to use with its top edge under the line I was reading (to stop myself skipping ahead to see how it was all going to turn out); not one of my professors and tutors had the wit to tell me to use it to block out the bit I'd finished with.

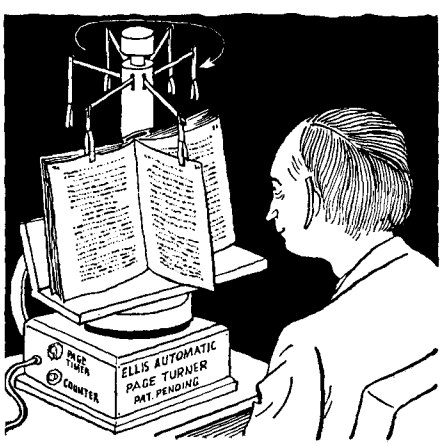
However, that is all spilled milk. Let's get back to the present and consider one more rule for speedy reading. It's a fatal mistake to "sub-vocalize." This is a handy term for what you have been doing all this time — not exactly mumbling each word to yourself as you come to it but speaking it inside your head, so that you can, in a sort of way, sub-hear it. Sub-vocalizers (and I admit I was one myself, until this lifesaving article came my way) will never get on, because they are *ipso facto* condemned to read at no more than a jog-trot talking pace. What a way to tackle *War and Peace!* "Sub-vocalization," whatever you may think, "is unnecessary," as can be proved, the writer points out, "by making the reader repeat a nonsense phrase all the time he is reading."

We are now ready for a trial run. Kindly read this paragraph a line at a time, letting the eyes move steadily down with none of that swiveling from side to side that is better suited to tennis-watching than to intellectual pursuits; keep your shutter device going if you have one; on no account go back to the beginning, however much you are enjoying yourself; and don't forget to repeat "So she went into the garden to cut a cabbage leaf to make an apple pie" until you've reached the end.

Good. Complete mastery of the new technique may not come at the first attempt — and of course that was a tricky little test in a way, because when you were reading "So she went into the garden . . ." you were actually repeating those very words — were you not? — thus introducing that element of sub-vocalization we were at pains to avoid. For your next test it will be better to choose a nonsense phrase that does not actually occur in the piece you are going to read. This is not always an easy thing to do; but I have found (and the reader may care to make a note of this) that "So he died, and she very imprudently married the barber" will take one right through *Hamlet* without serious overlapping.

One curious little difficulty about streamlined reading, not referred to by the writer of the article, is the sluggishness of one's emotional reactions. Reading, for a man of sensitivity, is not just a matter of immobile assimilation. The brows are drawn down in sympathy or disapproval, the fingers drum nervously at moments of excitement, tears prick the eyelids. And these responses take time. Not much time, but longer than you might think. Meanwhile the lines flash by; and more and more, as my speed increases, I find myself physically outstripped by events. Amused by some comicality in Dickens, I am shaken by laughter at a time when my eyes, far ahead in their supersonic career, are scanning the death of Little Nell. I pale with rage over some item in my newspaper that happened a column or two further back. This gives a touch of incongruity to one's reading, and may make it necessary for me to pause for a few minutes between books and let my responses catch up.

A secondary problem, not much likely to bother the reader of this article but capable of seriously holding up a man trying to get through a rice-paper edition of the Bible before bedtime, is the purely mechanical difficulty of turning the pages fast enough. Time wasted in leaf manipulation can undo much of the advantage gained by the avoidance of unnecessary eye movements, and there does seem to be a need for some kind of device (perhaps an attachment to the shutter?) that would perform this tedious office — at a predetermined rate, of course. If it could be made to do the actual reading as well, so much the better. The reader would then be free simply to repeat nonsense phrases to himself, undistracted by the written word.



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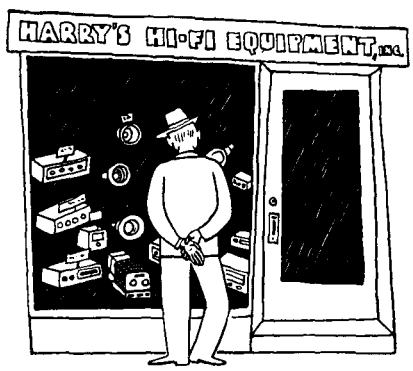
# THEY SHALL HAVE MUSIC

## PROGRESS IN HI-FI

BY JOHN M. CONLY

In some ways I like my friends to be old-fashioned. It is gratifying to be reminded occasionally that Hollywood offers nothing now to compare with Greta and Norma, that nobody today builds a car like the old Packard Twelve, that we really lost something when Farrar retired, that Dempsey could have taken Floyd Patterson in half a round. Such remarks are born of nostalgia, and everyone enjoys a touch of nostalgia once in a while.

However, there is another way of being old-fashioned which is much




less appealing. It partakes less of glamorizing the past than of being reasonlessly timid about what is new, even when a new development may be unarguably superior to what has preceded it. Such timidity, no doubt, long preserved the carpet sweeper against the vacuum cleaner, and the coal stove against the gas range. Me it plagues chiefly in another area, as follows:

"Of course I love music and listening to records," my friend tells me. "But I'm afraid I just couldn't cope with high fidelity. It's too technical. All those wires and things."

This used to leave me without retort, since — five years ago, let's say — there was an element of truth in it. Then, as now, separate home audio components represented the best possible buy in living-room musical equipment, but they could also represent a certain amount of work and of puzzlement. The dealers were largely electronics parts wholesalers who had found, to their surprise, that music-loving private citizens were interested in buying their wares. But neither the dealers nor the manufacturers behind them were accustomed to dealing with folk totally unacquainted with matters electronic. And the instructions they furnished these latter were sometimes painfully inadequate.

Further, there really *were*, sometimes, wires to be bought, cut to length, connected, even soldered. And often there was confusion about whence to where the wires went. I recall a very intelligent young man's calling me up once, at about midnight, because his loudspeaker had two terminals, mystically marked red and black, whereas his amplifier had four, mystically marked G, 4, 8, and 16. The loudspeaker also bore the cryptic legend 16Ω, from which he had shrewdly deduced that one wire should go to the amplifier's 16 screw-on terminal. But where should the other one go, and should it lead from the red or the black connection? These were all very reasonable questions. It simply never had occurred to the manufacturer or the dealer that not absolutely everyone knew that loudspeaker leads are reversible, that one always goes to ground (G, see?) and the other to the appropriate output-ohm tap (16, of course!).

Now operating procedure for the buyer of high-fidelity components has been much simplified and much more intelligibly documented, so I no longer need shrink into mortified silence when an acquaintance says, "It's too *technical*." If it is a paterfamilias who speaks, as it usually is, I wither him promptly with the suggestion that he turn the technical problem over to his wife. Whereas he, I suggest (meanly), can cover his technological lag behind an array of efficient assistants and secretaries at his office, his helpmeet at home has no such protection. All by herself she must figure out and apply the control readings on the electric rotisserie, connect the polishing attachment to the vacuum, and pre-set the washer-dryer to the proper adjustment for shirts, sheets, and diapers. To anyone who can do that, complete mastery of a 1957 high-fidelity amplifier should take no more than 128.30 seconds. (This is a scientifically unacceptable figure, since it is based on measurements taken in only a single case, but it *is* food for thought.) Sometimes this argument works.

When I say it works, I mean it works on the male in the household. Even when simplified and shorn of its psychological subtleties, it does not work on the female. As a general thing, she is not taken aback by electrical complexities. She is used to dealing with these pragmatically, by trial and error. Her ego is not

involved. What she does boggle at, though, indomitably and with a skill handed from mother to daughter through countless generations, is the way the thing is going to *look*.



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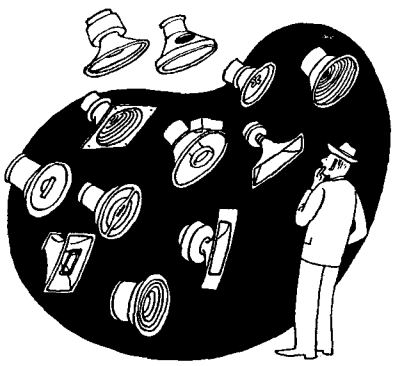
These two facets of objection to high fidelity must be treated together, and not — no pun intended — altogether facetiously. Music is one of the very greatest refreshments of the spirit. This is an age in which the human spirit stands constantly in need of strong refreshment. And it is also an age in which music has been made available, in unprecedented vividness, to every home (in America, at least) that will accept it. To reject it, if its need is felt, seems to me preposterous, foolish.

A digression is necessary. High fidelity never has been defined by the industry that produced it. Nevertheless its essence is well known to the people who have and enjoy it. The table-top record player priced at $99.50 and the modest console which costs $199.50 today are de-



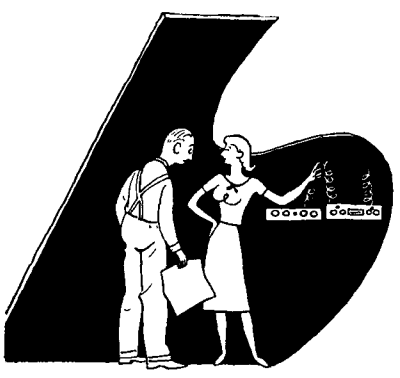
cided improvements on the radio-phonograph of 1947, but they are not high fidelity. They can make good records sound like good records. A high-fidelity array can do something subtly but drastically different. It cannot bring the Philadelphia Orchestra into your room, or move your room into the Academy of Music. But, if your room is of a size to accommodate a real, live tenor with guitar, or a harpsichordist, and if such an artist has been captured on a disc with unflawed realism, a high-fidelity rig can reproduce him sonically in your room in such fashion that you could close your eyes and confuse the reproduction with the original, were he present. This is the distinction.

Let it be said here that high fidelity *can* be bought packaged in single consoles. I have heard some that I would not mind owning. None of them, however, cost much less than $800. And in no case within my experience would I hesitate to promise that I could match their sound, with judiciously chosen separate components, between half and three quarters their price. In other words, there really has been a helpful revolution, in the last eight years, in the musical furnishing of living rooms. And it is a revolution directed not solely at the man handy with a soldering iron, but at everyone. Further, its shape has been in accordance with this aim.

The most immediately noticeable change is that the common box is gone. Almost the only wood you buy now is an enclosure for the loudspeaker, and its solitary function is to enclose the loudspeaker *acoustically*. Unless you are willing (or anxious) to pay for a facsimile of real symphonic impact — which your neighbors might take amiss — it will be much smaller than the old console. Yet it will, by virtue of sealing and padding, enable the speaker really to probe the bass range where the bassoon and the 32-foot organ pipe make their effect.

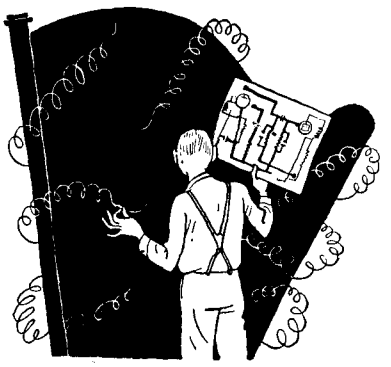
From this enclosure will trail a pair of wires, usually, these days, in the form of a 300-ohm, ribbonlike twin-lead, such as is used to bring in the signal from a television antenna. These can be obtained in the color of your choice, and can run easily under rugs and over moldings. The objective of the twin copper strands is two screw terminals on the rear of your amplifier, labeled G and 16 or 8, as the case may be.

Your amplifier — provided you settle for no more than twenty watts of power, about ten times what your elderly radio-phono could supply — will be a device about one foot broad, a couple of inches high, and as deep, front to back, as your abridged dictionary. It can fit on a bookshelf (at eye level, which is a convenience), and its tubes and condensers are hidden by a punched metal grill cover, finished usually in



what is described as brushed gold. At any rate, it is no eyesore.

If you have a radio tuner — AM-FM or just FM if you live in a metropolitan area — it will be about the same size and shape as the amplifier. Indeed, if you want, it can be bought



on the same chassis, in which case the combination will be six inches high. If you prefer the units separate, for aesthetic reasons or to space out the expenditures, the two will be connected by a short length of coaxial cable, discreetly covered in gray plastic and terminated at either end with a plug-in pin-tip connector. The fitting terminal on the tuner will be marked "output." That on the amplifier will be marked "tuner." If you have trouble figuring out this connection, it can safely be entrusted to any literate ten-year-old child in the neighborhood.

Close by the tuner socket on the rear of the amplifier will be another, marked "phono input." Without serious cerebral strain, it can be deduced that this should receive the plug at the end of the cable from your record-playing assembly.

Your record-playing assembly, whether you buy it piecemeal or as a unit, will consist of three components: a pickup cartridge (with diamond stylus, at least for LP records), a tone arm, and a turntable. If you buy a changer, you get also a mechanism which will automatically play the first movement of the Brahms First right after the first two movements of the Beethoven Seventh, if that is the way you like to hear these selections.

However, changers are viewed these days as somewhat non-U, and so are lidded boxes to conceal precision turntables and tone arms. I must recommend them nevertheless to folk who live in grit-ridden cities. For other people, it is now thought proper to let a turntable and arm, tastefully mounted on their boxlike base, stand unabashed in the open, functional as andirons or ash trays.

The pickup cartridge, incidentally, should be a magnetic or FM type.



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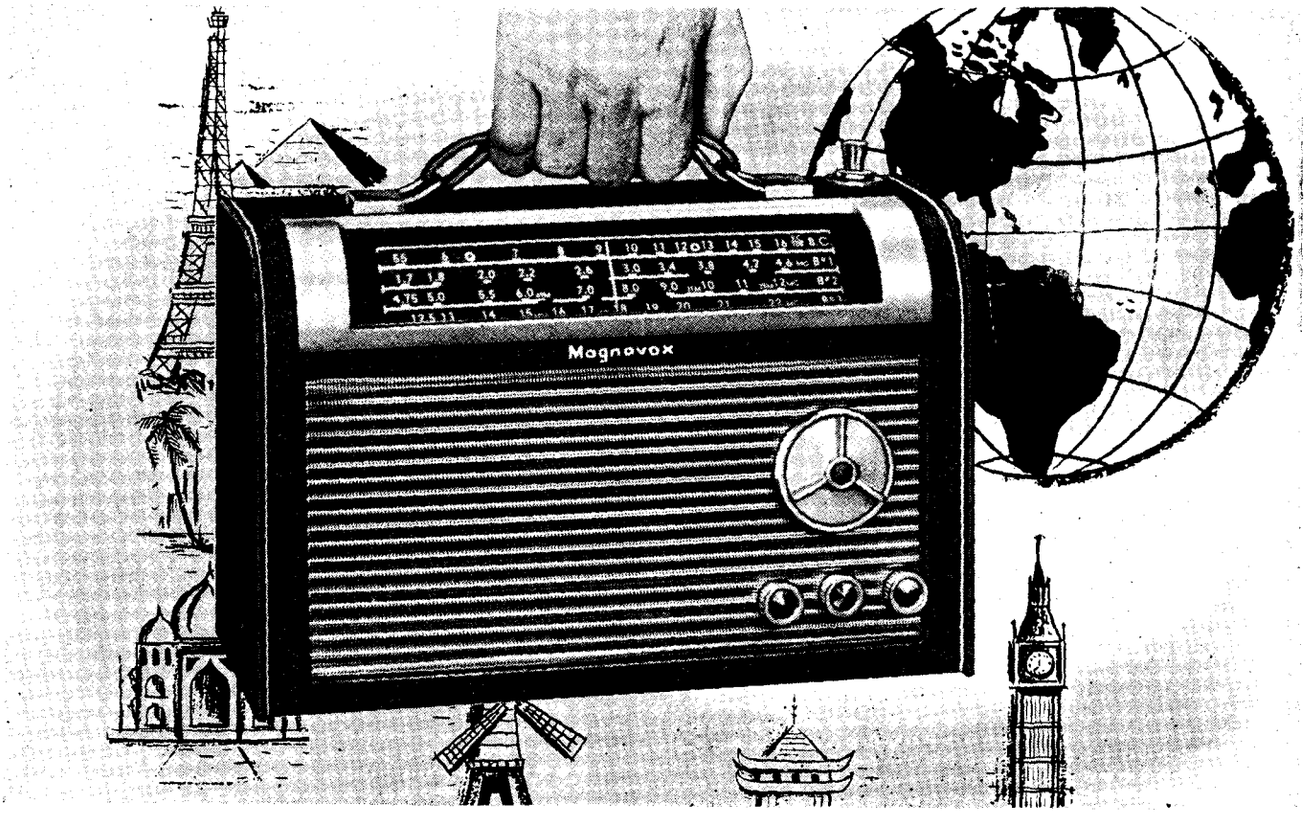


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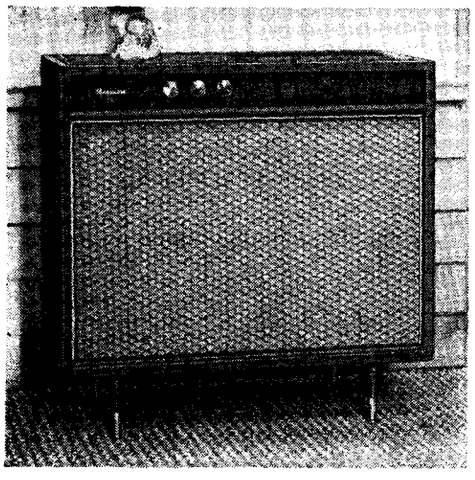

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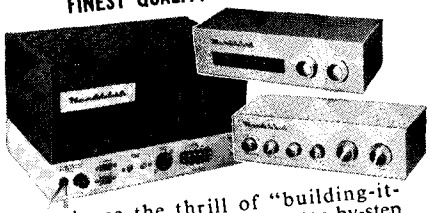

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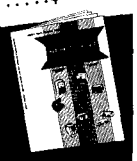

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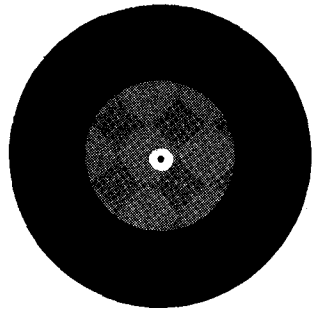
The low cost ready-made phonograph employs a ceramic or a crystal. These work reasonably well on newly made records. But only about half of the discs pressed before 1955 — perhaps half of those now in the catalogues — fall into this category. For the others magnetic cartridges must be used, to permit the amplifier's equalization controls to come into play.

And here is the last frightening aspect of high-fidelity equipment. It shouldn't, really, frighten. There is nothing mysterious about equalization. Record makers always, in cutting discs, have raised the volume of their treble and lowered that of their bass. The idea was to mask surface noise (treble) and prevent unduly wide groove-swing (bass). The playback amplifier — even in your ancient radio-phono — produced the desired readjustment by reducing treble reproduction and boosting bass.

However, with the onset of wide-range high fidelity, it became obvious that the readjustment had to be precise. And the trouble was that the record makers had not all used the same degree of treble boost and bass attenuation. Columbia, for instance, had applied 16 decibels of treble boost, whereas RCA Victor had applied only 13.5. In 1955 the manufacturers assembled and agreed on a common degree of treble boost and bass attenuation. But records made earlier remained incompatible. So, which do you want — strident Beecham or dull Toscanini? Or equalization controls, by which you may make either one sound right? Is it too much trouble? Too technical? Do you likewise insist that your stove, set for the same heat, should in the same time properly bake four tiny Rock Cornish game hens or a twelve-pound turkey?

Let us, at the end, be a little serious. The reproduction of music in the home is, beyond much question, the field in which the layman, the recipient, can most nearly join the artist, the creator, in any of today's creative activities. The proper placement of a loudspeaker, the accurate adjustment of a tone control, the careful leveling of a turntable, can make of any of us a collaborator, in a great adventure, of Arturo Toscanini or Pablo Casals, not to mention Ludwig van Beethoven and Giuseppe Verdi. Is this not worth the exercise of a little wit?



# *Record Reviews*

**Beethoven: The Creatures of Prometheus**
*Willem van Otterloo conducting Hague Philharmonic Orchestra; Epic LC-3366: 12"*

When Beethoven was about thirty, he wrote a score for the Vienna City Ballet Theater on the subject of Prometheus, the Titan who stole fire from the Olympian gods, and with it animated clay, and thus launched Mankind. As might be expected, the ballet was complicated and preposterous. The music is not. There is some ordered prettiness, but through it strides martially the marvelous pride in humanity that was to elevate all the later works and make them ageless. This is the first complete recording, and a very good one: Otterloo knows what he is about and the microphones abet him faithfully.

**Dvořák: Quartet No. 7 in A-flat, Op. 105**
*Janáček Quartet; Decca DL-9919: 12"*

In the Janáčeks, out of Brno, Decca has got hold of what is patently one of the best string quartets in the world, at least for music like this strong, serene Dvořák piece, written partly in America, late in the composer's life. Their joyous mastery of and submission to the music is something rare and exciting. With the sound reproduction, no complaint.

**Glière: Symphony No. 3, "Ilya Mourometz"**
*Eugene Ormandy conducting Philadelphia Orchestra; Columbia ML-5189: 12"*

Ilya Mourometz was the Sir Lancelot of Russian legend. Like Lancelot, he was never defeated but by unfair divine intervention, at least until he ran afoul of Reinhold Glière (1875–1956). This is a terribly pompous piece of music. However, though unworthy of its subject, it abounds in orchestral devices ideal to test the



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prowess of Ormandy's Philadelphians and your high-fidelity system. It sounds solid as oak and slick as silk.

**Prokofiev: Piano Sonatas**
*Yury Boukoff, piano; Westminster XWN-18369, 18370, 18371: three separate 12"*
Prokofiev's piano sonatas are not his most exciting musical products, to my mind, but on the other hand they show no sign of the Politburo pressure for conventionality and comprehensibility (lazy tovarish level) that distorted some of his larger-scale works. They are divided among the discs 1–4, 5–7, and 8–9. The young Bulgarian, Yury Boukoff, is obviously an intelligent pianist, awake to Prokofiev's wit and irony, and the recordings are highly adequate.

**Rimsky-Korsakov: Scheherazade**
*Ferenc Fricsay conducting Berlin Radio Symphony Orchestra; Decca DL-9908: 12"*
The Berlin Radio orchestra here sounds almost as rich as its municipal sister symphony, the Philharmonic, perhaps in part because of very skillful reproduction. Moreover, Fricsay appreciates Rimsky as orchestrator; nothing is wasted. But he does not appreciate him as storyteller in quite the same way as William Steinberg does for Capitol.

**Schubert: The Death of Lazarus**
*Arthur Winograd conducting Helmut Kretschmar, Barbara Troxell, other soloists, chorus, and Hamburg Philharmonia Orchestra; MGM E-3526: 12"*
Having ventured into secular opera without any marked success, Schubert at twenty-three reverted to the Biblical oratorio-opera of famous precedent — Handel — to make for us this piece of healthy melancholy. It has moments that recall *Jephtha* and Beethoven's *Mount of Olives*, but mostly it is pure Schubert — maybe a little too pure, for there is a dearth of contrast and stress. Still there is plenty of melodic invention, and Arthur Winograd, at least, does well with it. The singers are no more than competent.

**Richard Strauss: Till Eulenspiegel; Death and Transfiguration**
*Fritz Reiner conducting Vienna Philharmonic Orchestra; RCA Victor LM-2077: 12"*
To me Toscanini's *Till* remains the last word, but Reiner's is certainly in the running for second place. And his *Tod und Verklärung* probably is


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the best we have. The recording is resplendent, the Viennese virtuosi and their fine hall never sounded better, and Reiner's insight as a master-Straussian grows keener as he gets older. It is hard to set him above the late Clemens Krauss, so I won't, but Krauss never had quite this kind of sound reproduction, a tremendous asset in Strauss.

**Fiesta in Hi-Fi**

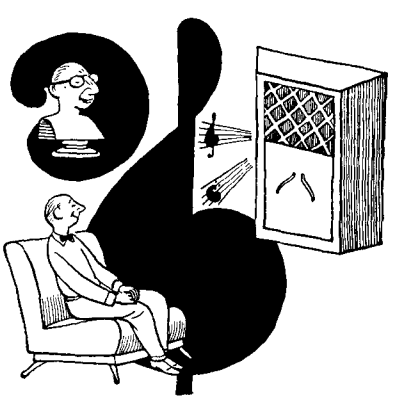
*Howard Hanson conducting Eastman-Rochester Symphony Orchestra; Mercury MG-50134: 12"*

The "Fiesta" consists of four American compositions. One has Mexican flavor, Robert McBride's *Mexican Rhapsody*. The others traverse the continent in keeping with their titles: Ron Nelson's *Savannah River Holiday;* Lyndol Mitchell's *Kentucky Mountain Portraits;* Charles Vardell's *Joe Clark Steps Out* — the last-named Virginian in origin. The common mood is not serious, but the wit, ingenuity, and rhythmic verve are of a very high order indeed.

**The Orchestra**

*Leopold Stokowski conducting unidentified orchestra; Capitol SAL-8385: 12"*

In his initial effort for Capitol, Leopold Stokowski leads an orchestra, assembled in New York for the occasion, in nine selections chosen to show off the various sections of a modern symphony orchestra. The brasses, for instance, disport in the Fanfare from Dukas's *La Péri*, the percussion in part of Harold Farberman's *Evolution*. Two of Mussorgsky's famous *Pictures* demonstrate the whole orchestra. Obviously both musicians and engineers joined zestfully in this project, and of course no one else in the world could have directed and supervised it so well as Stokowski, a pioneer experimenter in high-fidelity sound reproduction and an inimitable musical educator. The sonics are all crystal and thunder.



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